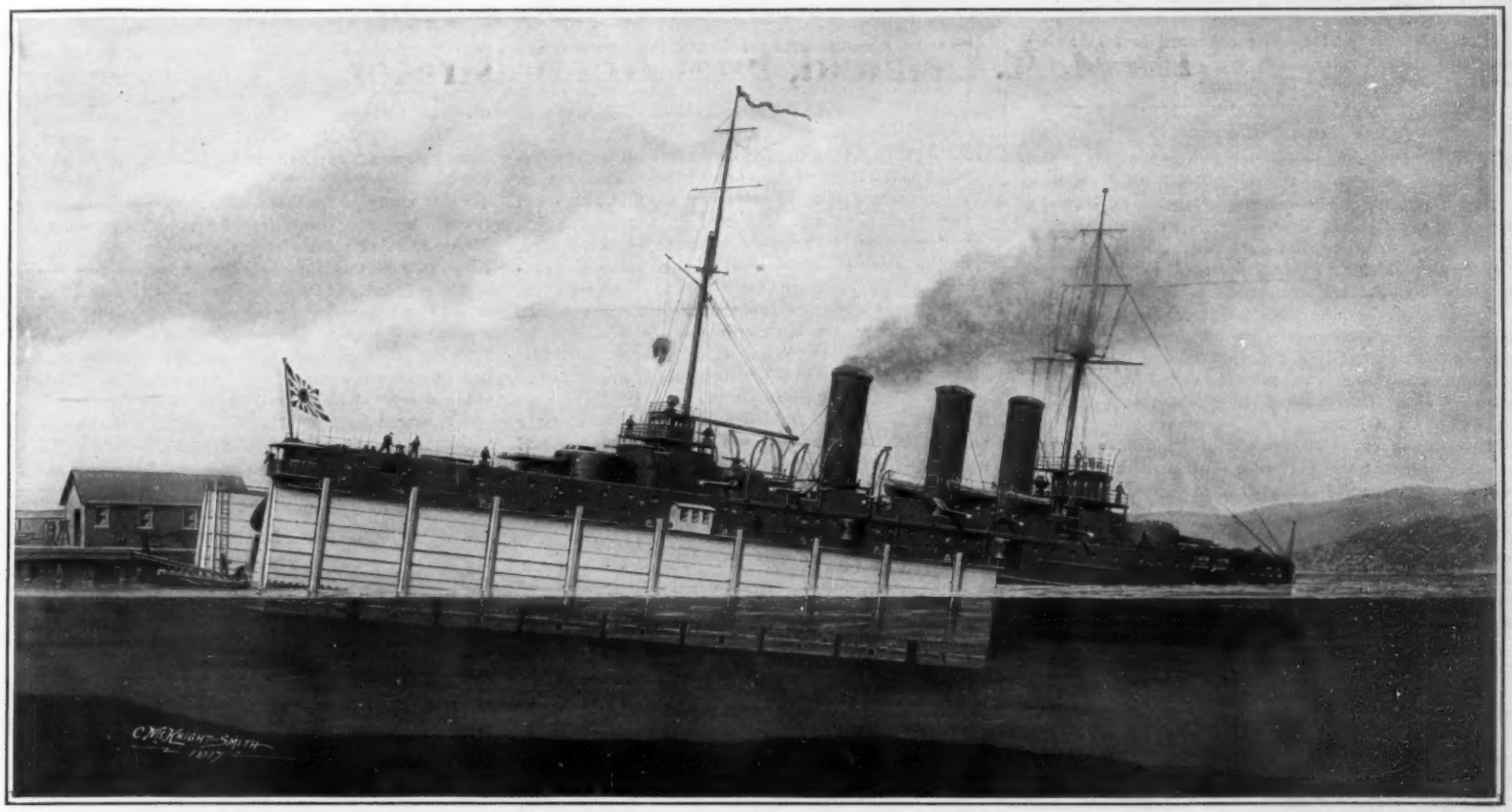
SEVENTY-THIRD YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXVII. NUMBER 15] NEW YORK, OCTOBER 13, 1917 [10 CENTS A COPY $4.00 A YEAR



The rudder of the Japanese cruiser "Azuma" of 9,300 tons, was repaired by using a 4,500-ton floating dock to lift the stern of the ship clear of the water. To prevent the ship from sliding out of the dock, she was anchored to the structure by chains and steel hawsers

DOCKING A 9,300-TON CRUISER IN A 4,500-TON FLOATING DOCK

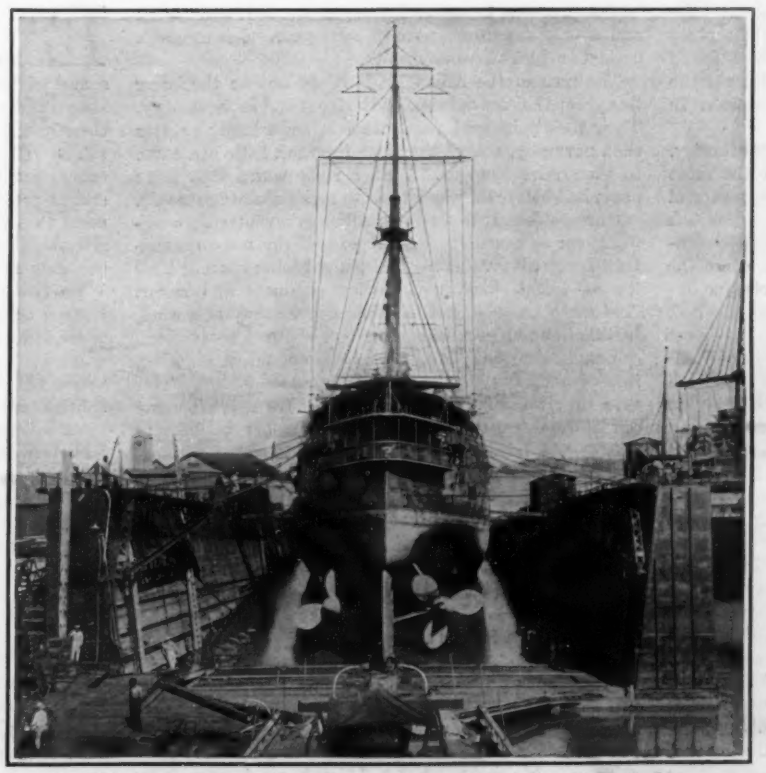
Docking a 9,300-ton Cruiser In a 4,500-ton Dock

THE feat of lifting a ship, 446 feet long, 59 feet in beam, and 25 feet in draft, and having a displacement of 9,300 tons, in a floating dry dock 300 feet long and of only 4,500 tons capacity, was the problem recently solved by Mr. J. A. Lyle of the Inter-Island Steam Navigation Company of Honolulu, when the Japanese cruiser "Azuma" was docked to make repairs to a damaged rudder.

Evidently, it was an absolute impossibility to lift the vessel's entire hull with a dock having a capacity of a little less than half the cruiser's displacement; so calculations as to flotation and submergence of the dock and ship were made to see what could be done. It was found that by shifting weight on the vessel it would be possible to provide a requisite percentage of buoyancy forward to keep the bow (which projected beyond the end of the dock approximately 158 feet) water-borne or self-floating.

It was found that, if this shifting of weight were done, the dock would be capable of lifting the stern of the vessel several feet clear of the water. This was accomplished by pumping out the lifting pontoons so proportionately, that the end of the dock under the forward end of the ship was at its maximum submergence while the other end was at the same level as when exerting its full lifting power.

In this position the keel blocks of the dock were on a 5-degree angle, or an approximate grade of 27 feet in 300. This made it necessary to hold the vessel firmly on the blocks by chains and steel hawsers, leading aft from the ship to the dock. Otherwise the ship would have been in danger of sliding out of the dock while the repairs were being made. Upon the completion of repairs the pontoons were gradually flooded until the cruiser was entirely water-borne, when the shifted weight was returned to its place and the vessel again floated at its normal water line.



This view shows the propellers and after part of the ship entirely clear of the water

The "Azuma" will be familiar to those of us who followed the naval campaign of the Russo-Japanese War. She is one of six similar armored cruisers of a type which was very popular at the time, nearly twenty years ago, when she was built, all of the principal navies possessing similar vessels. The ships of the "Azuma" class are the "Aduzma" and "Iwate" built by Armstrong in 1899 and 1900. The "Aduzma" built in 1899 at St. Nazaire, France; the "Yakuma" built by the Vulcan Works at Hamburg and the "Asama" and "Tokiwa" built at the Armstrong Works in 1898. All of these ships were very active in the operations of the Russo-Japanese War and most, if not all of them, took part in the great battle of Tsushima.

The armored cruiser may now be considered a practically obsolete type. It was the forerunner of the battle-cruiser to which it has given place. The armored cruiser does not carry sufficiently heavy armor plate to enable it to stand up against the fire of capital ships—as witness the fate of the British armored cruisers, when on emerging from the mist and smoke they suddenly came under the fire of the German Battleship Fleet. The duties of the existing armored cruisers of the various navies must be confined, as in the present war, to duties of patrol and convoy.

The armored cruiser makes an excellent flagship for a convoying fleet of destroyers. She carries a numerous battery of 6-inch guns, and her fore and aft 8- or 10-inch guns could sink, at long range, any submarine that attempted to approach at the surface.

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, October 13, 1917

Charles Allen Munn, President. Frederick C. Beach, Secretary. Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Copyright 1917 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

A Naval Offensive

THERE is an insistent demand on the part of the younger men among the Allied Navies, our own included, for a stronger offensive against the navies of the Central Powers. Some of these critics go so far as to state that the Allied fleets have lost the initiative and have permitted themselves to be immobilized by submarine activity.

In a superficial glance at the situation, the charge might seem to carry a color of truth; for the German and Austrian surface fleets are undoubtedly enjoying complete immunity behind the mine fields and coast defense guns of Kiel, Heligoland, Wilhelmshaven and the Austrian base at Pola.

It is one of the elementary truths of strategy, say these critics, that the duty of a superior fleet is to find and destroy the enemy; and this, they aver, the Allied Command is taking no active steps to accomplish. The Allies are possessed of a vast preponderance of naval strength and a decided preponderance of military strength, and it is urged that they should make use of this by initiating a bold offensive, using their combined land and sea forces to reduce the enemy's naval bases.

It seems to us that the answer to this is obvious. In the first place, if sufficiently powerful forces were detached from, let us say, the Western front, for an attack on naval bases, it is probable that the Allies would lose that initiative which has been theirs for over a year; and it might well happen that the Germans, conscious of the enormous natural and military strength of their coast defenses, would concentrate their land forces in one tremendous effort to break through the weakened Western front.

Apart from the military risk involved in such a venture, it is certain that a naval attack by capital ships against the naval bases would not only fail to make any serious impression but, because of the shoals, sandbars and narrow channels of the German coast and the enormous strength of the heavy gun and mortar batteries of the German fortifications, any such attack would mean the loss and disablement of the flower of the Allied dreadnought fleets. For let it be understood at once that it would be futile to send against the German coast defenses old predreadnought battleships, such as failed against the comparatively antiquated forts at the Dardanelles; they would be hopelessly outclassed in range and in weight of metal.

We have it on the very best of German naval authority, and we have known it for some years, that the most important of the German coast defenses include powerful batteries of 16-inch high-powered rifles and 16-inch mortar batteries. To send a fleet even of super-dreadnoughts into the fire zone of these batteries, where the ships would be restricted to narrow channels and incapable of that maneuvering which is one of the best defenses against gun fire, would be simply to court disaster. However, although we believe that an offensive against the sheltered German and Austrian fleets would be suicidal, we are strongly of the opinion that a more vigorous offensive should be undertaken against the German U-boats. That is to say, instead of allowing the U-boats to carry the offensive to the Allies in the Channel, the Atlantic, and the Mediterranean, the Allies should carry the offensive to the submarine in the North Sea and the Adriatic.

But how? Obviously, by attacking them at the source, at the exit from their bases, or as near to their bases as the exigencies of the situation will allow.

The weapons suitable for such offense, as developed during the war, are many and various, including the net, the mine, the aeroplane, the depth bomb and the gun mounted upon a craft sufficiently seaworthy to remain on station at least from ten days to a fortnight.

When we mention the net we have in mind, of course, the live net, or what we have already designated in these columns as the bomb-curtain, in which the net serves to carry a closely-spaced mine field held in a vertical plane. The alternative method to the live net is to use successive rows of anchored mines, the rows being separated in the vertical plane by intervals of say 20 feet, so that if the whole mine field were projected on one vertical plane, the area would be as effectively covered as if the bombs are carried in a single net. Offensive operations of this kind can be carried out locally, at the several U-boat exits, or in one location, as in the case of the great projected net stretched from Scotland to Norway.

The most serious difficulty in the maintenance of nets which has developed during the operations of the war is their tendency to become heavily loaded with drifting seaweed. When they are so loaded the total area of the net exposed to the pull of the tides is enormously increased, and not only does the loading down tend to pull the nets under, but the accumulated stress ultimately reaches a point at which the net or its moorings part and it is swept away.

Of course, the answer to this is that the nets were not made of sufficiently heavy gear. We are still confident that it would be possible to build a net of such heavy "scantling" and make the mooring gear of such weight and strength that the nets could be held.

It is our belief that the British have been unduly discouraged as the result of their net failures. The problem should be taken up "de novo" and it should be attacked progressively. Let a serious trial on a more massive scale of construction be made, let us say at Zeebrugge, where the water is shoaler and the depths are not prohibitive. If the Zeebrugge net stood the test it would be in order to tackle the mouth of the Elbe and the entrance to Wilhelmshaven. If the continuous net is found to be impracticable, the mine or bomb-curtain effect should be attempted by the use of successive lines of mines laid at varying depths as suggested above.

Can anyone dispute that it would be sound strategy to exhaust every possible means of offensive operations of this kind at the entrance to the German bases, rather than permit the U-boats to come and go at will, and choose their time and place of attack on the transatlantic and Mediterranean routes?

The Consumer's Contribution

THROUGH spring and early summer the press and the forum were loud in urging upon the agriculturist the necessity for extreme productive activity on his part as the price of deliverance from world famine. He was implored to plant every scrap of land, to employ the most intensive methods of crop stimulation, and above all to see that no guilty wisp of grain, no last handful of fruit or vegetable, escape his harvest.

The response to this campaign has been excellent. To be sure, there have been slackers and profiteers here, as they have been found in every field. There have been those ready to share the viewpoint of the editor who congratulated the farmers of his state for having done their share toward winning the war, in increasing the value of their wheat crop by nearly fifty million dollars, though at the same time they had permitted it to fall off by two million bushels. But they have been in a great minority; the American farmers as a class cannot be too highly praised for their fine work during this extraordinarily difficult labor year.

The producer has done his part; our 1917 crop is in, and now he can do no more till next year. Let us check up and see just where we stand.

The men of the Allied Nations are not on the farms this year; they are fighting, at the front and in the factory. Their deficit in food production is accordingly greater than normally, and at the same time but little can come to them save from us. With a right which they have never had before they look to us to make good their needs.

Our problem is to feed our Allies this winter by sending them as much food as we can of the most concentrated nutritive value in the least shipping space. This means wheat, beef, pork, dairy products and sugar. And these are at once the foods that we may best send, and that our Allies most need.

England, France, Italy and Belgium, taken together, import normally 40 per cent of their breadstuffs. This year they must import 60 per cent. We must increase our normal export surplus of 88,000,000 bushels to 220,000,000 bushels. We can substitute corn for wheat in the making of bread; our Allies cannot. For they have few corn mills, and corn meal is too perishable to be shipped in large quantities. Moreover, they rely upon bakery bread exclusively, and corn bread cannot be thus distributed. They do not ask for wheat merely because they prefer it to corn; they ask for it because they can use nothing else. There is but one way out; we can substitute corn for part of our wheat consumption, and we must do so. We use now an average of five pounds of wheat flour per week per person. The whole problem will be met if we will replace one pound by corn or some other cereal, reducing our wheat consumption to four pounds.

The food animals of the Allies have decreased by 33,000,000 head since the war began. Our meat exports to them are almost tripled. Their needs will steadily increase as their own production of food animals falls off because of lack of feed for them. If we save a single ounce of meat per person each day we can send the Allies what they need. The necessity for economizing in milk and butter stands obviously upon the same grounds.

Before the war France and Italy produced as much sugar as they used, while England drew most of her supply from what are now her enemies. France and Italy have lost in production, while England is cut off from the usual source of 70 per cent of her consumption. These three countries must have two million pounds more than before the war, and they can only get it from the same source that we employ. We must divide with them, and we can do it by a trivial economy.

It is not as though we were asked to do without any essential feature of our diet. We are not; we are merely asked to substitute. Use corn, oats, rye or barley in place of wheat. Use up all stale bread in cooking. Use poultry and sea food in place of beef, mutton and pork. Use soups and beans more freely; to a large extent they replace meats. Use all the milk; use less pure cream; use lots of cheese. Substitute other fats for butter in cooking. Double the use of vegetables, of which we have a superabundance. Put a check upon your sweet tooth.

Upon many of us these measures, or even more extreme ones, are being forced by market conditions. Many more of us are still able to compete with the Allied governments in the purchase of wheat, beef, butter and sugar, and will continue in possession of this ability. It is to this part of the community that appeal must be made. We are not asked to deprive ourselves so that someone else may feast. We are asked only to reduce our consumption in a wholly harmless degree, in order that our Allies shall have a living ration.

We cannot hope to win the war, or even to lose it, without a certain measure of personal inconvenience to every one of us. As we go along, the realization of this will dawn upon us and the will to submit be born in us. But just as England must suffer for all her mistaken viewpoints of the first year, we too will not be relieved, next winter, of the consequences of our failures to appreciate the war this year. If we have not, right now, the will to submit to such trivial inconvenience as is involved in the measures outlined above, we were better out of the war, and in process of absorption into that greater Germany of which the Prussian still dreams.

The producer has done his part; he is through until next year. His labors then will doubtless depend largely upon the showing of the coming winter. It is now the consumer's turn to make his contribution, to demonstrate to the producer that his efforts of 1917 have really been for the good of the cause. Will he do this, or will he make it plain that the motive behind the campaign for increased production was merely an unholy fear lest he be forced to modify in some detail what is certainly the highest standard of living ever enjoyed by a general public? Have our farmers been working this summer to win the war, or have they been chicaned into serving our collective stomach?

A Letter from "Over There"

EVERY one is interested in the work that our boys are doing on the other side and in the spirit they are showing now that they are living close to the sound of battle. One of the truly encouraging things about the present situation is the splendid morale of these young men, their complete readiness for sacrifice.

The following fragment of a letter from a young college student has fallen into the hands of the Editor, and is presented as a striking example of the state of mind that animates our men near the front. It makes refreshing reading indeed to us who have heard so much babbling and disloyalty from a certain group of Senators. When we read such self-sacrificing sentiments as are printed below, it brings the flush of anger to our cheeks to realize that these Senators are embarrassing and nullifying in every possible way the work of our noble young fellows "over there"; and we can only hope that it brings the blush of shame to those guilty of disloyalty.

"I was never so happy as I am now over here and I look forward to the future with the lightest of hearts. Please don't worry because it does no good. If I go down in this war you ought to be proud. It is the biggest cause now and I am willing to take my chances in the front line trenches or going 'over the top,' if need be, with the rest of the boys and I intend to see it through by all means. If I didn't I would feel like a fool the rest of my life, and I would much rather be underground out here with the others than leading a soft life at home or putting the issue off hoping that the war would be over before I had to go, the way some fellows are doing. I know you and mother must feel the same way. We ought to have been in it three years ago and now, thank God, we have at least done the decent thing before it was too late. Write soon and often as I have not yet received any mail from home. With lots of love to Mother and Sister."

Electricity

Electricity Replaces Kerosene in Locomotive Headlights.—It is announced that the Baltimore & Ohio Railroad has commenced the installation of electric headlights on all of its locomotives, totalling about 2,500. The improvement will be made at the rate of from 75 to 100 engines a month.

Electricity as a Trench Digger.—It is reported that the French are making extensive use of electricity at the front, including the operation of all kinds of excavating machines. Working in ordinary earth, four men with two wheel-barrows and a machine driven by an electric motor can shift from twenty-five to thirty-five tons a day. In a month a shelter with sleeping accommodation for 500 men can be dug by a single company.

Government Specifications for Gas-Filled Lamps.—A conference has been held by representatives of the United States Bureau of Standards with the engineers of the manufacturers of incandescent lamps for the purpose of revising the general Government specifications for such lamps. The Government now uses nearly 2,000,000 lamps per year, and purchases are based upon these specifications. For the first time, it is planned to include specifications for the new gas-filled incandescents.

New Insulating Material from Fish Offal.—The *National Tidende* of Copenhagen, Denmark, notes the invention, by a Danish chemist, of a process by which fish offal may be made to yield not only oil, but also a solid substance, called "corimite," which is specifically suitable for electrical insulation. The newspaper states that a company capitalized at $18,750 has been formed to work the process, and that production is expected to begin during the present year.

Electrical Standardization in France.—According to the London *Electrician*, the French Electrotechnical Committee has decided on various measures for the standardization of electrical machinery and other electric apparatus, some of which are mentioned in French periodicals. On many of the points publication is not permissible at present, but it is understood that the steps proposed refer to insulated cables and the standardization of the production and transmission of energy and electric machinery. The measures will be considered with regard to similar steps being taken in Great Britain, Italy, and the United States.

"Coasting" as a Factor in Electric Railway Operation.—Because of their weight and consequently their tremendous momentum after attaining a fair rate of speed, electric cars and trains are capable of "coasting" for the greater part of the time on level stretches. It is only of late that railway companies have come to realize the importance of "coasting," and many of them have installed "coasting" indicators which keep an automatic record of how much "coasting" there is for each trip. Motormen, knowing that a record is being kept of their work, take advantage of the momentum of their cars or trains in "coasting" as much as possible. The result is that the power consumed is materially lessened, and therefore the operating expenses are reduced to a considerable extent.

Wireless at the Front.—Although very little has been permitted to pass the censors, it is understood that wireless is being employed to an unprecedented degree on the battle front in France. In the front line trenches the aerial wires are strung along a parapet just behind the barricade. In the support trenches the aerial wires are elevated a few feet above the ground, while far to the rear the aerial is generally elevated to about twenty feet by light bamboo poles. The sectional masts familiar to our Army pack sets and wagon sets are practically unknown in the war zone, for the reason that a modest aerial a few feet above the ground is sufficient for the short ranges which must be covered. Wireless telegraphy is a necessity in communication work, because of the difficulty of laying telephone and telegraph lines and then maintaining them across shell-sprayed terrain.

Telegraphic Transmission of Photographs between Berlin and Constantinople.—According to the *Annales des Postes, Telegraphes et Telephones*, Dr. Korn proposes to introduce his system for the telegraphic transmission of pictures on the Berlin-Vienna-Sophia-Constantinople-Bagdad route. For this purpose either telegraphic or telephonic connections could be utilized. So far as telephone connections are concerned, one could conceive stations at Vienna and Budapest in connection with Berlin, the lines being occupied for a quarter of an hour only. In these circumstances pictures of an event taking place in the afternoon could appear the next day in the Vienna journals. Transmission for longer distances (*e. g.*, from Berlin to Constantinople), would involve the use of telegraphic lines, which would enable an ordinary photograph to be transmitted in about an hour. The chief expense involved is the occupation of telegraph and telephone lines between such distances, but it is thought that the governments of the four countries concerned might grant very moderate rates if the lines were only used during hours when there is little or no traffic.

Science

Meteorology in the Italian War Zone.—A special meteorological service, organized by the Italian Army, with headquarters in Rome, has been publishing quite an elaborate series of little bulletins and leaflets dealing with practical questions in meteorology and climatology having military bearings. These comprise especially discussions of the climate of regions lying within the war zone, and detailed information concerning avalanches, with lists of places especially subject to them.

Short Gestation of a Mare.—A note in the *Comptes Rendus* reports the case of a mare, Walkryie, which foaled November 7th, 1915, after only 233 days of pregnancy; a record which reduces materially the minimum period of gestation hitherto stated for horses; viz., 287 days. The offspring, which was perfectly viable, weighed 128 pounds, and had a height to the withers of 36 inches. The only apparent incomplete part at birth was the epidermis of the feet, which grew rapidly during the first few days of the foal's life.

Freezing Experiments with Fruit Trees.—Messrs. West and Edlefsen, of the Utah Agricultural Experiment Station, have described some elaborate experiments on the hardiness of fruit buds to different degrees of frost, entailing the use of novel apparatus. The investigators constructed a large cabinet of galvanized iron, consisting of two half-cylinders on rollers, with an iron cover. An entire living tree could be enclosed in this cabinet, and the air inside cooled to any desired temperature by the use of ice and salt. An electric fan kept the temperature about the tree uniform. The temperatures were recorded by minimum thermometers and a thermograph. Budding fruit trees were thus exposed to more or less severe "freezes" for various lengths of time, and the yields of fruit in the following autumn were compared with those of neighboring unfrozen trees bearing approximately the same number of buds. The results of these experiments are set forth in Utah Agricultural Experiment Station Bulletin 151.

An Ingenious Method of Eradicating Weeds in the Hawaiian cane fields has been devised by Mr. C. F. Eckart, manager of the Olaa Sugar Co. Immediately after harvesting, the rows of stubble, after being cleared of trash and fertilized, are covered with strips of lightweight tar or asphalt felt paper. Stones and trash are placed over the paper to prevent it from being blown away. When the new cane shoots emerge from the ground they are rigid and sharp enough to penetrate the paper, while the softer weeds cannot do so. The process is facilitated by slitting the paper at points where little tent-like elevations reveal the presence of shoots. The weeds are smothered out or dried up by the solar heat radiating from the under side of the covering. When the shoots first emerge they are, naturally, quite etiolated, but they soon turn green and grow vigorously. Besides a great saving of labor, this process is said to result in an increase of yield averaging 10 tons to the acre, owing to the mulching action of the paper and its absorption of solar heat, and consequent heating of the ground.

An Elaborate Study of Different Grades of Milk for infant feeding has been made by Messrs. Washburn and Jones, of the Vermont Agricultural Experiment Station, at Burlington. The experiments were carried out with baby pigs, on the assumption that the results are, in general, applicable to human infants. A comparison was made of the effects of feeding skim, medium and rich milks, note being taken of the resulting size, weight, agility and other qualities of the young pigs. The general conclusion was that the body of the animal should not contain much more than 1.6 parts of fat for every one part of protein, and that this composition could be obtained by a ration carrying a nutritive ratio of about 1:3. A study was made of the relative values of Holstein and Jersey milks, leading to the conclusion that the size of the fat globules has no practical bearing on the relative values of milks in infant feeding, and that any superiority for this purpose attributed to Holstein milk is more likely to lie in its comparatively low fat content than in the small size of the fat globules. Experiments with homogenized milk indicated that homogenization of the fat is not helpful in feeding the young. Tests were also made with evaporated (unsweetened) and condensed (sweetened) milks. Both were readily digested and assimilated. Evaporated milk was found to compare very favorably with normal milk, but sweetened condensed milk, while showing an abundance of energy value, proved to be an undesirable food for the young, since its nutrients were so proportioned as to produce a weak and dangerously fat body. Other important studies related to the effects of milk food upon the structure of the bones, especially in connection with rickets and other forms of malnutrition. The femur of the average pig fed sweetened condensed milk was but two-thirds as strong as that formed when normal milk was fed. Evaporated milk was nearly equal to normal milk in this respect. The results of these studies and many others relating to milk are set forth in Bulletin 195 of the Vermont station.

Astronomy

Telescopes for Variable Star Observers.—The secretary of the American Association of Variable Star Observers, Mr. William Tyler Olcott, Norwich, Conn., states that the association wishes to raise a fund the interest of which can be used to purchase small telescopes to lend to worthy observers of variable stars who are unable to procure telescopes of their own. Contributions are solicited from anybody who is interested.

Movements in a Spiral Nebula.—From an examination with the stereocomparator of two photographs of the great spiral nebula in Canes Venatici, one taken in 1896 and the other in 1916, M. Kostinsky, of the observatory of Pulkowa, finds apparently systematic movements, with respect to the center of the nebula, in 36 nuclei or centers of condensation. The nuclei in the outer spiral are receding from the center, with a counter-clockwise movement, while those in the eastern part of the inner spiral are moving clockwise and toward the center. The proper motion of these nuclei amounts, in general, to from .04 to .05 second per annum.

The Smallest Known Celestial Object, according to a note in *L'Astronomie*, is a faint asteroid recently discovered photographically by Rev. J. H. Metcalf. Its photographic magnitude was estimated Sept. 24, 1916, as 17.1 when it was distant from the sun and the earth 1.84 and 0.93 astronomical units, respectively. Correcting for phase and color index, the visual magnitude was 14.3, and assuming the albedo to be equal to that of Mars and the more brilliant asteroids, an actual diameter of between two and three miles is indicated for the object. In other words this Lilliputian world has a surface area less than that of a great terrestrial city, and is probably very much smaller than the satellites of Mars.

Falls of Meteorites in Wisconsin.—Three remarkable falls of meteors are reported to have occurred in Wisconsin on July 4th, about 6.20 P. M. Two occurred at Colby, and the third near Cornell, 57 miles distant. They were accompanied by loud explosions heard for many miles around, while those at Colby were attended by smoke trails. The explosions at Colby shook windows for miles, and at Athens, 20 miles away, were likened to boiler explosions. Both of the Colby meteorites were recovered; one weighed 80 pounds and the other 200 pounds. The meteor at Cornell was very much brighter than the sun, and is said to have "just missed an auto party," a statement which need not be taken too literally.

Needs of Astronomy.—A statement setting forth the most urgent needs of astronomy has been issued by the astronomical committee of the National Research Council. One of these is an increase in the facilities for observations in the southern hemisphere. More large reflectors are needed in both hemispheres, in order to extend a wide range of observations to the fainter stars. Several items of routine work on a large scale are suggested, the collective result of which would be to make possible the publication of a catalog showing the approximate positions, proper motions, radial velocities, magnitudes, spectra, color indexes, etc., of all stars down to magnitude 6.5, and provision for bringing this list up to date every three years.

The Total Lunar Eclipse of Jan. 8, 1917, as described in some of the European journals, presented the peculiarity that the moon's disk became almost completely invisible in the earth's shadow. Generally the moon glows with a copper-colored illumination throughout the eclipse, owing to sunlight refracted through the earth's atmosphere, and it has even been photographed while near the middle of the shadow. The amount of illumination evidently depends upon the amount of clouds present in the belt of the terrestrial atmosphere lying in the path of the refracted sunlight. In 1848 the moon remained so bright while passing through the shadow that some people doubted whether there was really an eclipse, while in 1884 the lunar disk could scarcely be seen with a telescope.

The Invention of the Achromatic Telescope is usually associated in books on astronomy with the name of John Dollond, though it is well known that Dollond was anticipated in this invention by Chester Moor Hall, an Essex barrister. Dollond was awarded the Copley medal of the Royal Society for this invention in 1758, and secured a patent for it about 1760. In a recent number of *Notes and Queries* some fresh information on this subject is published by Mr. R. B. Prosser. In 1764 a petition from 35 opticians of London and Westminster urged the revocation of the patent granted to Dollond for achromatic lenses, on the ground that such lenses were made by George Bast, optician, in 1733, in accordance with the specifications of Hall, and that another optician, Robert Raw, told Dollond of them in 1755. In a suit brought after John Dollond's death against the optician James Champneys for infringement of the patent the plaintiff secured damages, the judge, Lord Camden, holding that the invention had not been adequately "published" by Hall.

The Submarine Problem—XVII.

A Submersible, Anti-Submarine Buoy

IS it not surprising that the element of secrecy or surprise, which represents 90 per cent of the submarine's effectiveness, has been so greatly neglected in the Allied offensive against the U-boat?

In our last issue, we drew attention to the amazing failure of the Allies to use their large submarine fleet in an offensive against the enemy. The value of such attack, energetically carried on in the submarine zone, would consist in its *invisibility*. The German might find himself "hoist with his own petard."

In the present submarine chapter we show a novel and well-worked-out device, whose tactical value consists mainly in its possession of invisibility. It is a weapon of position, designed to be used in large numbers for presenting a wall of observation, through which a U-boat cannot hope to pass, either at the surface or submerged, without detection.

Each buoy with its listeners, telephones, gun and gun crew is an outpost, designed to detect the approach of the enemy and bring up its own ships to capture or destroy him.

The principal features of this device, which has been brought to our attention by the designer, Mr. C. W. Kelsey, are as follows:

1. Ability quickly to submerge.

2. Comfortable accommodations for a crew which is able, at all times, to communicate by telephone with other similar buoys and with the shore stations.

3. Ability to listen-in most effectively, either on the surface or submerged, because of the absence of distracting noises from the buoy itself.

4. Being equipped with wireless, flares, submarine bells, etc., direct communication can be had with patrol boats, destroyers and other friendly craft.

5. Ability to maintain station regardless of weather conditions.

6. All buoys being numbered and anchored at known positions, and all of them listening-in at the same time and in communication with each other, they will be able to approximate with considerable accuracy the speed and location of any moving submerged submarine within the range covered by the listening apparatus. This data being transmitted by wireless to the destroyers, they can be placed on the trail of the submarine, with a prospect of its capture or destruction when it comes to the surface.

7. Because of its ability quickly to submerge, the buoy would be practically immune from attack.

The buoy itself is approximately 16 feet in diameter and about 20 feet deep from the deck to the top of the compressed-air tank, which extends below the buoy structure proper in the form of a cylindrical tank in which compressed air is stored for operating purposes. At the bottom of this compressed air tank, as will be seen, is placed a cable drum with gear attachment operated from the living quarters. Upon this cable drum is wound the anchoring cable, to which is attached an anchorage weight of sufficient size to ensure absolute maintenance of the buoy in place. Submergence is accomplished, as in the submarine, by the admission of water, and by the downward pull obtained by winding up the cable drum. The submerging tank is located just below the living quarters' floor.

The equipment is similar to that of the submarine itself, and it includes a periscope, air compressors, wireless outfit and telephone, with microphones for listening-in. The gasoline engine and its tank for fuel supply are housed in watertight tanks, located on the upper deck. The ammunition, also, is carried in a watertight receptacle.

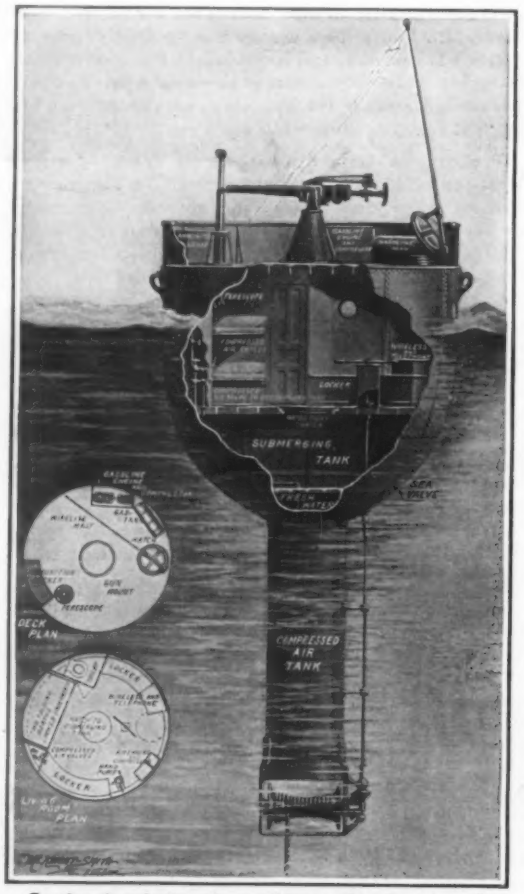
Acting in concert with the buoys is a telltale net of very light construction. Each unit of these nets is 40 feet by 200 feet, and it is held in place by light bamboo poles at the top and bottom, the bottom poles being weighted so as to keep the whole series or line of nets, as far as possible in a vertical position.

From the upper bamboo pole an attachment is made with a small, specially shaped and constructed buoy, which is provided with a telltale flag and a light, and which notifies the captain of the submersible buoy when a submarine is in contact with the nets.

Normally, these buoys would float just above the surface with the hatch open, the crew being stationed, one man on deck as a lookout, one man listening in or operating the telephone, and a third man on general duty; while the fourth man is turned in for sleep.

The Droop of Big Guns and the Causes

THE subject of droop in guns has only lately received considerable attention, because it is only in recent designs that the length has been great enough to produce any appreciable bending. A droop may be defined as the bending of a gun due to the elasticity of the metal and to the imperfections in the manufacture of the gun. It may be expressed also as the angle that the final tangent of the curved bore makes with the axis of the gun at the breech. In guns of 12-inch caliber and larger the length of the bore forward of the trunnions has become so great that the bending can be detected by the unaided eye. In some cases the droop has been found to be more than one-half an inch. The deflection of the actual gun will never be less than this computed amount, but will be greater, according to the conditions of assemblage. The causes of droop of guns may be divided into three general heads, namely, elasticity of metal; design of gun; imperfection in the manufacture of the gun.



Sectional and plan views of buoy, showing air and ballast tanks, sleeping quarters, etc.

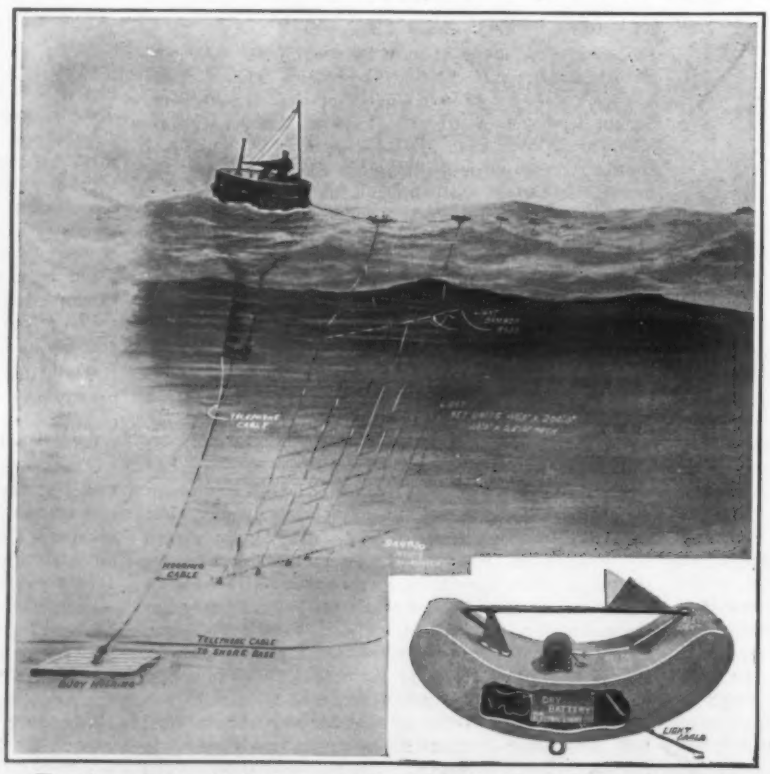
A formula has been developed by U. S. Naval Ordnance Engineer Jeansen for computing the deflection of heavy guns. This formula gives the deflection of droop in a gun caused by its own weight, considering the gun as a beam, irrespective of the system of assembling or locking the various pieces of the gun together. The depression of a gun is the theoretical bending of the elastic gun under ideal conditions. The flexure of a long gun, due to the unsupported weights in front of the cradle, is modified to a considerable extent by a general difference of temperature. The manufacturer of guns also plays an important part in the amount of droop.

A Periscope for the Boiler House

STOKERS are always told to economize coal and improve their firing, but they cannot always tell, without going outside, whether the chimney is smoking and this is important, both as a matter of economy in burning coal, and also to enable them to conform with smoke regulations. The suggestion has been made to place a mirror outside the building, setting it at such an angle that the men, looking out of the window, can see the reflection of the top of the chimney in the mirror.

The Current Supplement

AN article of value in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2180, for October 13th, is on *Ultra-Violet Radiation*, being a spectroscopic investigation of some sources of ultra-violet radiation in relation to treatment by ultra-violet rays. *War Ships Old and New* shows illustrations of what is called the first "Dreadnaught," built in 1514, and a modern battleship of the Super-Dreadnaught type, and gives comparative data that are of interest. *The James River Concrete Arch Bridge* describes a new railway structure of considerable importance, and gives instructive figures relating to the same, together with an excellent photograph of the structure as it will appear when completed. *Adaptation and Disease* is a lengthy abstract of a series of lectures on evolution delivered at the Royal College of Physicians, in London. *Archaeological Investigations in the Virgin Islands* describes work done at St. Thomas, one of our recently acquired possessions with a view to solving the riddle of the origin of the aborigines. It is accompanied by a large number of photographs by the author, and gives an interesting description of how such investigations are prosecuted. *The Fumigation of Greenhouses* describes conditions that result in injury to leaves and flowers by "burning", and offers practical suggestions by which this danger may be avoided. *The Making of a 6-inch Reflecting Telescope* is continued. *The Parachute Up-to-Date* briefly reviews a primitive form of aircraft, and describes a new form for use with aeroplanes. There is a long letter discussing the recent paper on The Nature of Matter which will interest all who read that article.



These buoys, each containing four men and an outfit of telephones, listeners etc., would be anchored across the waters traversed by submarines.

Submersible anti-submarine buoy and nets in position

Eliminating White in the Signal System of Railroads

THE new color scheme of signal indication, by which white lights will be eliminated altogether, was placed in effect on all lines of the Pennsylvania Railroad east of Pittsburgh at noon on June 28th last. Nearly a year of preparatory work had been required to make this change possible. Great difficulty was experienced in obtaining deliveries of materials, owing to war conditions.

The decision to eliminate white from the signal color scheme was reached on account of the increasing use of white lights of various kinds in buildings, driveways, roads and streets close or adjacent to the railroad's right-of-way. Under the new plan, green will replace white for "clear" or "proceed." "Caution" will be indicated by yellow. Red will mean "stop" as heretofore.

In addition to changing the glasses in all the semaphore signals, the following devices have been altered to conform to the new plan of color indication:

Marker lights on the rear of passenger and freight trains; switch lamps and targets; markers for track tanks; "slow" signs; "resume speed" signs; and hand lamps at interlocking and block signal stations. No changes have been made in those short portions of the line which are protected by "position light" signals, the longest of which is the electrified section from Philadelphia to Paoli, Pa.

Feeding the Battling Airman's Machine Gun

ONE of the thousand-and-one problems involved in the design and construction of a battleplane is the feed for the machine guns. When the usual type of machine gun is used, the cartridge belt must be handled so that it will not warp and twist or in any other manner cause the gun to become inoperative at the height of an aerial engagement. With the battleplane flying at all angles and even upside down, the difficulty of maintaining a uniform, reliable feed is at once obvious. Indeed, it is the sure feed of its disk magazines that has made the Lewis gun so popular among airmen, outside of its light weight.

Recently the designers of battleplanes introduced a reel method of feeding a machine gun. In the accompanying illustration appears a typical case, and it will be noted that the regulation belt with its cartridges is held on a reel at one side of the gun. In some cases the empty canvas belt is collected in a suitable receptacle at the other side of the gun, while in others a spring-operated reel is employed to take up the belt, so that there is no chance for warped, twisted or entangled belts.

Fed from a reel mounted on the machine gun, the cartridge belt of this airman cannot twist or become entangled

In some of the German fighting machines, particularly the single seaters, the ammunition belts feed out of one magazine situated beneath the gun, into the gun and out at the other side into a second magazine, so that only a short section of belt is at any time exposed. The spent cartridges are also collected, because of the metal which they contain. An elaborate system of feeding and collecting is employed in the twin-gun types of German fighting planes, where two belts are fed at one time and collected again. The magazines, which are built into the engine hood, are readily accessible.

A U-Boat Which Met Its End Through Fog

RECENTLY a fog, friendly to the Allies, caused one of the newest large German submarines to lose its bearings and become stranded on a sandy beach along the French coast, somewhere near Calais. The German crew, seeing how hopeless was the situation, set fire to their petrol tanks and blew up their undischarged mines on board, causing the more or less total destruction of the craft. A short while later they surrendered to a Belgian cavalry patrol and were escorted to the nearest camp.

Stranded on the French coast and blown up by its crew: A German U-boat undergoing a searching examination by French marines

The stranded U-boat is reported to be of the latest type, being provided with the usual deck guns and a saw-edged sloping bar of steel at the bow for the purpose of shearing its way through wire netting, should it be trapped at any time. In the accompanying view an idea can be formed of the extent of the damage wrought by the explosion of the mines. Here is seen part of the engine room in the form of the powerful Diesel engines and a collection of twisted pipes. The conning tower is just above this, and appears to have been little damaged by the explosion.

Guards Who Protect Paris Against Air Raids

DESPITE its proximity to the battle line and the German aerodromes, Paris has been comparatively immune from hostile air raids during the past two years, while London, a considerable distance away from the nearest German air basis in Belgium, has been the continual target of Teuton bombing raids. Strange as it may seem, the cause for this state of things is to be found in the very nearness of the French capital to the fighting line; for between their lines and Paris the German airmen must fly over a territory which virtually bristles with guns and swarms with defensive and offensive aircraft, as compared to the scattered anti-aircraft defences encountered on the long journey to the British metropolis. This does not imply that London is practically undefended; far from it, the city is well provided with all manner of anti-aircraft defences. But the size and extent of the city make it a very difficult object to defend against aerial raiders.

As an example of the air defences of Paris the accompanying illustration is of prime interest, for it shows an emplacement for a 75-millimeter quick-firing gun arranged for anti-aircraft work. It will be noted that the piece is mounted so as to swing about a center pivot, and its mounting provides for seats for the gunners and the time-fuse setting devices, seen with shells inserted, at the extreme right. The gun is sheltered in a circular shed in the center of which there is a large opening through which the gun has a clear sweep of the skies. Ammunition for the gun is piled about the shed.

One of the numerous fixed anti-aircraft guns which protect Paris against hostile airmen

Death of George Augustus Avery

A JOURNAL of such long standing as the SCIENTIFIC AMERICAN may very proudly number on its staff men who have served it faithfully for a great many years.

It was nearly forty years ago that Mr. George Augustus Avery entered the service of the SCIENTIFIC AMERICAN as a wood engraver. He came with a reputation for very excellent work, which reputation grew until the process of photo-engraving suddenly displaced hand work. Mr. Avery began his career at the age of 18 under the tutelage of John P. Davis, one of the most distinguished engravers of that period. Later, he worked for the house of Frank Leslie. The task of illustrating the SCIENTIFIC AMERICAN, and the SUPPLEMENT which had been established only a year before Mr. Avery entered the service of Munn & Company, proved so great that his brother, Montgomery, and then the latter's son, Harold, were also enlisted in the service of this journal. When the demand for wood engraving suddenly waned, Mr. Avery, who had always shown a fondness for literary work, associated himself with the Editorial staff of the company. He was ever a most industrious and conscientious worker, and remained in active service despite failing health up to the summer of this year, when his physical condition compelled him to retire. He died at Nantucket, Mass., on September 22d, and was buried there, in the Quaker Cemetery.

Mr. Avery was born in Nashville, Tenn., in 1844, but was brought up in Philadelphia. He was the twin brother of Rebecca A. Day, wife of the late Benjamin Day, the well-known inventor. Mr. Avery was a descendent on his mother's side of the famous Quaker preacher, John Woolman, his mother's name being Mary Woolman Comfort. During the Civil War, Mr. Avery was too young to be drafted into the service, but he ran away from home and joined his brother in the 71st Regiment of New York. Although his period of service was short, only a matter of three months, he was actively engaged in the repulse of Early's raiders and was commended for bravery in holding an exposed post. He was a man of powerful, athletic build, and was greatly interested in outdoor sports. At one time he held the position of Vice-President of the Manhattan Athletic Association. His literary tastes were very marked and he accumulated a very extensive library. He was also fond of art and music; and loved to travel, especially in Europe. His chief relaxation after a hard day's work was to bury himself in a Baedeker and make a mental journey through France or Switzerland or the British Isles. One of his pet hobbies was nieteorology, which developed in him a rare capacity for statistics.

Mr. Avery leaves behind him the memory of a very kind and gentle nature of almost childlike simplicity, a disposition to look for the best in those with whom he associated, and an unsparing devotion to the work and the interests of the SCIENTIFIC AMERICAN.

Who Gets It First?

The Priorities Committee of the Council of National Defense and How It Answers This Question

By C. H. Claudy

THE capacity of the Bingville Chain Company is 1,000 feet of steel chain per day. On a certain date John Jones wanted 30,000 feet of steel chain. So did the War Department, likewise the Coast Guard, also the Mudhook Dredger Company. At the same time a foreign government, a shipbuilding concern, a chain hoist company and a big building contractor also had instant need for 30,000 feet of steel chain.

They all wanted it day after tomorrow.

John Jones almost got it, because John Jones wanted it badly enough to pay the regular price, *plus* the bonus offered by the foreign government, *plus* five per cent for being given preference over the dredger company, a regular customer, *plus* another five per cent for haste. But just as he was about to take possession of his chain, the Navy offered a still higher price and walked off with the goods, and John Jones was left out in the cold!

If there is a reason why the Navy ought to have a ton of dynamite or a load of coal or an ingot of steel or a bale of hay before anyone else, some one must have the deciding power as to the validity of that reason. If there is a necessity for the Army to have some artillery wheel spokes or some optical glass or a million yards of silk or all the tent pegs in the world before anyone else, some one must decide the fact. The manufacturer can't do it. He has his hands full manufacturing. The head of the particular Bureau which places the order can't do it—he is convinced beyond all argument that no one needs that material half as badly as he does.

Imagine such a state of affairs multiplied by 10,000 factories—imagine army and navy and non-military government departments all bidding against each other to get immediate deliveries, and the entire government organization competing, not only with its own multitudinous units, but with the commercial world, and it is easily seen that not only would price chaos result, but that war work would be disorganized.

Complicate the situation by supplying the United States with a lot of Allies, all of whom want everything the United States wants, and want it as fast or faster, and the reason for the Priorities Committee of the War Industries Board of the Council of National Defense, is at once plain.

If there is a reason why the Navy ought to have a ton of dynamite or a load of coal or an ingot of steel or a bale of hay before anyone else, some one must have the deciding power as to the validity of that reason. If there is a necessity for the army to have some artillery wheel spokes or some optical glass or a million yards of silk or all the tent pegs in the world before any one else, some one must decide the fact. The manufacturer can't do it. He has his hands full manufacturing. The head of the particular Bureau which places the order can't do it—he is convinced beyond all argument that no one needs that material half as badly as he does. He is convinced because he is an American, and therefore, in love with his job, and it's the most important job in the world.

The question cannot be settled by any single purchasing agent or any single manufacturer, because while the man who makes range finders, for instance, might readily agree that the navy's needs were greater then the army's, and that all private or foreign orders should fall in behind those from Mr. Daniels' office, it does not necessarily follow that all the people who make the materials which enter into range finders would see that the Jonestown Range Finder Company had a greater need for brass and copper and glass and leather and steel than all their other customers for these raw materials. So the matter of *who* gets *what*, and *when* he gets it, is not only a matter of determining the rotation in which orders for a finished product shall be filled, but of arranging that the manufacturer who must supply a certain product to a certain branch of the government before he does anything for any one else, shall have the necessary raw material with which to work and have it without waiting. Some system of delivery of material or manufactured goods other than "first come, first served" or "highest bid takes it" must obtain, if a badly confounded confusion is not to result.

So the Priorities Committee has come into being—a body with simply the authority which truth and necessity provides, but which functions as well as if given mandatory powers by law. It is composed of Judge R. S. Lovett, Chairman; Major Gen. J. B. Aleshire, U. S. A.; George N. Ormsby, Rear Admiral N. E. Mason, U. S. N.; Edwin B. Parker; J. Leonard Replogle; and Rear Admiral A. V. Zane, U. S. N. Mr. R. T. Demsey is Executive Secretary.

This is a working committee, which meets daily in Washington. It is interlocked with the War Industries Board, the Raw Materials Committee and the office of the Statistician of the Council, so that it is in complete touch with the demand for war material of all kinds.

As this is written there are in the mails some 25,000 copies of an important letter of instructions to manufacturers and suppliers of raw materials of all kinds, in which the Committee on Priorities advises that during the war in which the United States is now engaged, all individuals, firms, associations, and corporations engaged in the production of iron and steel, and in the manufacture of products thereof, are requested to observe certain regulations respecting priority.

These regulations first divide all orders and work into three general classes A, B and C, and each class into smaller numbered sub-classes. Orders and work of Class A takes precedence over Classes B and C, and Class B takes precedence over Class C; and subdivisions within a class are to be given priority according to the number of such subdivision.

Class A consists of war work—orders for war material or material urgently necessary in carrying on the war. Arms, ammunition, ships, etc., are examples. In Class B are orders and work, which, while not primarily needed in the conduct of the war, are yet of public interest, essential to the national welfare or otherwise of exceptional importance. A new dredge on the Panama Canal may be of extreme importance, yet not to be considered as a Class A order, since it has no direct bearing on the war. Class C comprises all orders and work not in Class A or Class B.

Then comes a most important regulation—"all materials required in the manufacture of an article, or the prosecution of any work, will be entitled to take the class of such article or work unless otherwise specified," etc. Suppose a gun manufacturer gets a priority certificate with an order from the Navy Department, specifying that the order is Class A 1, and that at the same time a bridge manufacturer gets an order from some government department which is Class B. If both need steel, the steel is automatically Class A1 for the gun manufacturer and the steel maker will so observe. It isn't left to his imagination to decide whether it is—subsidiary certificates for material are issued to the manufacturer of the finished product on request, so that a manufacturer filling a Class A order can accompany his orders for material with Class A subsidiary certificates.

Certificates are issued by the Committee on Priorities on the application of the official or Bureau giving the order or on application of a manufacturer. Regular forms are provided for all priority applications, which are as simple as they are plain.

For instance, let us suppose that the Bureau of Yards and Docks wants 1,000 tons of cement to complete a dry dock. It fills out an application for priority, addressed to the Committee, and specifying why preference is sought. If the Committee agrees that this order ought to be Class A, it issues a certificate to this effect, addressed to the cement manufacturer. And that is the end of the first chapter.

Certificates are issued by the Committee on Priorities on the application of the official or Bureau giving the order or on application of a manufacturer. Regular forms are provided for all priority applications, which are as simple as they are plain.

For instance, let us suppose that the Bureau of Yards and Docks wants a thousand tons of cement to complete a dry dock. It fills out an application for priority, addressed to the Priorities Committee, and specifying the grounds on which preference is sought. If the Committee agrees that this order ought to be Class A, it issues a certificate to this effect, addressed to the cement manufacturer.

Presently Mr. John Doe, the cement man, discovers that he hasn't any bags in which to deliver the cement. He must have them or he can't complete his contract. But Richard Roe, the bag maker, has a big order for bags from some one who is going to pack apples in bags because he can't get barrels. So Doe asks the Priorities Committee to issue a Class A Priority Certificate, subsidiary to the one served on him by the Dock Bureau, and directing Roe to give him bags before supplying the apple packer. If the Committee thinks that bags are essential to Doe in order that he may give cement to the Bureau, it issues this certificate, and that is the end of the second chapter.

For simplicity of illustration, a very simple and small order has been selected. Actually, the work of the Priorities Committee is complicated to the last degree. But the principle is in the above illustration; how easily confusion can result is readily understood when it is considered that not hundreds, but hundreds of thousands of orders are being placed by the government all the time. To direct the flow of material to Class A work, without completely holding up Class C and Class B; to decide whether the issuance of another Class A1 certificate may not do more harm than good, if sent to such and such manufacturer; to apportion the proper importance to similar orders from War and Navy Departments; to decide which of a thousand orders naturally in Class B can be considered as Class C in order to relieve the pressure and congestion on higher classes, and which Class A orders can perhaps be dropped into Class B—that is a work calling not only for the higest type of judgment and intelligence, but for the most painstaking work, a well developed system of filing and correspondence and an unerring judgment on the part of the members of the Priorities Committee.

It will at once occur to the man in the street to wonder what power the Committee wields to make its certificates regarded as mandatory.

And the answer is first, as it should be, patriotism. The manufacturer and the producer of raw materials of the United States have already demonstrated that they want to help the United States. It is known that the President is solidly back of the Council of National Defense, the War Industries Board and all its ramifications. Therefore, argues the manufacturer, these certificates come, really, from the President—they are the work of men who are wielding powers he gave them.

But there are other answers. Not all manufacturers are patriots before they are business men. Some are provided with instincts more highly developed commercially than in any other direction. To these there is the irresistible appeal of more orders. Manufacturers who do what they are told will of course be given preference in future orders over those who follow their own sweet will and pleasure in filling government contracts.

Finally there is the freedom from responsibility which comes to the manufacturer who fills orders according to priority certificates. He is assured of getting his materials. He cannot be troubled by those who order from him with Class B certificates or whose orders, not accompanied by any certificates, are necessarily Class C. The United States will see that, so far as subsidiary certificates specifying the class of the materials he needs can go, he will get them, and he needs no excuse for failure to comply with the terms of a contract calling for a delivery on a certain date, if the government itself has demanded that he lay aside this for Class A work.

The matter of orders placed prior to formation of the Priorities Committee has been very simply adjusted. All orders placed prior to September 21st by or on behalf of our War or Navy Department or the Emergency Fleet Corporation are classed as A1 unless otherwise specified by the officer placing them or by the Priorities Committee, and all orders for arms, ammunition and other military supplies and equipment placed prior to September 21st by or on behalf of any Allied nation are classed as A2 unless otherwise ordered by the purchaser or his agent or by the committee.

With hundreds of purchasing officers, with thousands of ramifications of the several great services of the government, all in need of materials and supplies, with a dozen foreign governments drawing heavily upon us for all that is needed to make war, from automobiles to zinc, from asbestos to zirconium, from artillery to zymmometers, nothing but hopeless confusion could result without a directing power to say who should get his wants filled first. This, in brief, is the function of the Priorities Committee, a body of men charged with a responsibility the careful custody and discharge of which means much to every commercial and patriotic interest in the land.

Turning the Tables

How "Potash from Cement" Has Been Twisted Into "Cement from Potash"

PORTLAND cement consists mainly of silica (SiO_2) and lime (CaO), with a certain amount of alumina (Al_2O_3) and ferric oxide (Fe_2O_3), and small percentages of MgO, SO_3, CO_2, etc. It is manufactured from a wide variety of clays and shales by a process of mechanical mixture followed by burning in a kiln. Now one thing which the etcetera above employed does not cover is potassium compounds; cement contains but the merest traces of these, if any at all. But the raw materials from which it is made do contain more or less potassium oxide (KO_2)—at times as high as 2.5 per cent, normally from 0.8 to 1.25 per cent. The elimination of this substance proceeds mainly through volatilization and exhaustion from the kiln.

For many years the cement mill has been an unmitigated nuisance, to itself only in less degree than to everybody else. The fine white dust which is blown from its kilns follows the universal principle that whatever goes up comes down, settling upon the fields for miles about and making agriculture a hopeless undertaking; and whatever dust fails to go up the pipes of the mill finds its way down those of the operatives, with unwholesome results. Damage suits and proceedings to enjoin operation as a public nuisance have become so much a part of the day's work with the cement maker that dodging a process server has got to be second nature with him.

From time to time it has been suggested that an effort be made to catch this dust before it gets away, and to denature it by removing the K_2O and whatever other agents of destruction it may contain. The means for doing this has always been rather up in the air, however, and there has always been a sneaking suspicion on the part of the mill owner that even if he knew how to extract neat little piles of various chemicals from his dust he would be confronted by the familiar question, "Now that you've got it, what are you going to do with it?" But the electric precipitator, which shakes the dust out of exhaust gases as easily as nothing at all, came along with an answer to the one objection; and the war, with its potash famine that we have all read so much about, made it perfectly plain what the answer to the other would be. This reduced the affair to its lowest terms—made it merely a chemical problem of how to treat the precipitated dust so as to recover the values in it upon a paying scale; and cement companies all over the country were quite ready to attack this problem, once assured that the potash market was well able to support any solution.

We don't propose to detail here the entire technique of potash recovery as at last successfully worked out by a big California cement concern; but certain features are well worth recounting. It appears from the first that the potash contained in the kiln dust is partly soluble as it stands, and that without further treatment this dust, in the present state of potassium supply, can be placed upon the market as a dilute fertilizer. In fact at least two eastern cement makers had given up hope of complete salvage, and contented themselves with this expedient. When potash returns to a normal basis at the end of the war—if the war ever ends—these companies will be up against it, since their output contains but 10 per cent potash at the very best, against a desired minimum for fertilizing effectiveness of 35 per cent, and since they are paying freight on 90 per cent of dead-weight.

The California experimenters determined to do better than this. But for some mysterious reason they were not able to make the kiln dust give up, in water-soluble form, more than 50 or 55 per cent of the potassium which went into the charge. Now while the potash goes into the kiln as the oxide, it comes out in the form of sulfate. The problem of complete recovery is therefore that of treating this sulfate. And the nub of the situation was presently found to lie in the fact that, in addition to the straight K_2SO_4, or potassium sulfate, there was being formed in the kiln a double sulfate of potassium and calcium, and that this merry little trickster, which is neither more nor less than the well-known mineral syenite, is practically insoluble at the low temperatures used in this work.

The point of attack was now obvious; and it was finally found that by keeping the mixture at a minimum temperature of 85° Centigrade during the leaching and filtering process, all the water-soluble potash originally present in the dust—not in the raw mix charged into the kiln, note carefully—could be removed. Given complete volatilization in the kiln, all the potash charged in would then be got out, and it would be theoretically possible to recover six pounds of potassium oxide per barrel of cement for each one per cent of K_2O present in the raw mixture. Even at pre-war prices this would be well worth while—always provided that it doesn't cost more to get the stuff out than it is worth. But ordinarily volatilization in the kiln is far from complete, so that all the potash that goes in is not found in the kiln dust; so attention was next turned to means for making more of the potash go up as vapor. This search has been rewarded with success.

According to the percentage of K_2O present in the raw mix, the appropriate amount of calcium fluoride (CaF_2) is added. At about 1100° Centigrade the calcium in this is displaced by potassium, forming potassium fluoride (KF) and lime (CaO). The boiling point of the KF, however, is only 850°, so it is at once volatilized, rapidly expelled, and carried off in the exhaust with the other combustion products and the dust.

Nor is this all. The exhaust gases are rich in sulfur oxides, and they attack the KF, converting it into potassium sulfate and liberating the fluorine in the form of hydrofluoric acid, HF. This promptly attacks the lime in the dust, throwing down water and—the very calcium fluoride with which we started. So the dust finally recovered from this complicated series of evolutions contains the K_2SO_4 which is the object of all the fussing, the CaF_2 through which the fussing was accomplished, a considerable volume of perfectly good cement-making raw materials, and some calcium sulphate. The potash is leached out; a simple reaction frees the residue from the $CaSO_4$, which is an undesirable citizen; and the balance, containing all the calcium fluoride originally employed, and the cement raws, goes promptly back into the kiln. So the process becomes a cyclical one, and wholly self-supporting; once it is started, all that has to be supplied by the hand of man is the heat demanded for the various reactions.

The technical details of this cycle have been so well worked out that at the present time it is found possible to volatilize 90 per cent of the potash contained in the raw mix (instead of 60 per cent as formerly); to catch 80 per cent of the volatilized potash in the dust collectors (instead of 55 per cent, or even less without the electric precipitator); and to filter out about 95 per cent of the precipitated potash. This gives a net recovery of about 66⅔ per cent. While there is left plenty of room for improvement, this figure is still highly satisfactory, and at the present market price of potash extraordinarily profitable. For the present demand for potash is a good deal like Coal Oil Johnny's thirst, which legend describes as unquenchable. The concern whose operations we have described finds that its potash output pays its entire operating expenses and leaves a reasonable profit, so that the cement, which will soon be produced at the rate of 5,000 barrels per day, is clear "velvet."

Of course, this state of affairs is temporary; the final success of the process must be judged upon its ability to compete with German producers on a peace-time basis. But the war-time market has paid the first cost of experiment and installation, and the manager of the company is sanguine as to the prospects. Of course, too, there is no immediate market for 5,000 barrels of cement per day. But when this cement costs nothing to make, the maker can afford to store it away as clinker. The covering costs are slight, and there are much worse things to own as an investment than large quantities of Portland cement, especially when the investment which it represents consists of zero dollars and no cents.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Oldest Subscriber?

To the Editor of the SCIENTIFIC AMERICAN:

I believe that I am your oldest subscriber, not the oldest man on your list, but the subscriber of longest standing. I was born June 12th, 1845, being the year that your paper was founded. In 1866 being 21 years old I left home and went into a factory to work and boarded with a family by the name of Lawson who had some old SCIENTIFIC AMERICANS. I became so much interested in them, that I concluded to be one of your subscribers and have been from that time to this with the exception of one break which lasted but a short time.

Having been a subscriber for the SCIENTIFIC AMERICAN for over fifty years, I think I have the honor of being your oldest subscriber. If not, I should like to know who is.

There is no use of my telling how I like the paper. The time that I have taken it, tells that.

C. B. T. HUTCHINS.

Menasha, Wis.

Things That Fall From the Sky

To the Editor of the SCIENTIFIC AMERICAN:

I read with interest your article in the September 15th issue "Things that fall from the Sky" and this brings to my memory a hot summer's day in the year 1890 on which a heavy rain came up suddenly—in fact it was practically a cloud burst. I was in the midst of this walking across a bare tract of land of about 160 acres, which was at least a mile from the nearest water; and I noticed as soon as the rain was over that the ground all around me for some distance was literally covered with small sun fish about 1 to 1½ inches long and small frogs about ¾ to 1 inch long and that these were as full of life as if they had just come out of the water.

I have related this instance to several people but it was considered a fish story. I am pleased to see in your article that this same phenomenon has really occurred in other sections of the country.

This happened at Grape Creek, a small town about six miles south of Danville. I have never seen anything like it since and reading your article recalled this to my memory.

JOSEPH FAIRHALL, JR.

Danville, Ill.

Merchant Ship and Airplane

To the Editor of the SCIENTIFIC AMERICAN:

The illustration alone, without reading further, given in your issue of September 22d "The Ideal Merchant Ship for Submarine Zone" in my opinion offers the best solution yet suggested for this problem.

Suppose that our government in fitting out its new Merchant fleet, the primary object of which is to offset the submarine menace, set about equipping these ships at small additional cost with this overhead structure for embarking and landing aeroplanes? Would not this structure underneath serve the two-fold purpose for conveying the great number of aeroplanes we will soon be ready to export, as well as supplying the floor-space overhead for landing aeroplanes?

Mention has already been made in your paper of the terrible destructiveness wrought by a bomb explosion in the water in proximity to a submarine. When we consider the number of fish that are killed by throwing a small stick of dynamite in fish infested waters, can anyone doubt that water must be a wonderful conductor of concussion or force? Therefore, it seems logical that the fate of a submarine would be doomed if an aviator dropped a fair-sized bomb within radius of 20 yards of submarine, if this bomb exploded, say ten feet under surface of water.

E. M. BLACKSHER.

Little Rock, Ark.

Small Farm Economy

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue a correspondent from Texas advises that farmers generally be urged to use tractors instead of teams, and to dispose of most, if not all of their live-stock in order to increase the quantity of human food-stuffs for market.

Let us consider briefly some of the effects of wholesale replacement of horses and mules on farms by tractors. The majority of small farmers keep only a few milch-cows for their family use, their small area not giving opportunity for cattle breeding. Therefore their principal source of animal manure is the farm teams. With the removal of the horses and mules there would inevitably follow, after a very few years, a progressive reduction in the productive capacity of the soil.

Furthermore, a major part of the sustenance of the farm teams consists of roughage of one sort or another, hay, stover, etc., but in order to satisfy the needs of human consumption there must be an extensive relative as well as actual increase in the production of concentrates, *i.e.*, grain, so that the soils would be subjected to a positive depletion in addition to the negative injury resulting from the lack of manure. It is a sound agricultural principle that not less than two-thirds of the product of the land must be consumed by animals on the land in order to maintain soil fertility. Therefore, it should be evident, even to a tyro, that while the extensive use of the tractor is well adapted to the large farm, where the absence of horses and mules can be compensated by increased production of meat animals, the small farmer must retain the animal as his source of traction.

The initial cost of the tractor, and the fact that it cannot perform all the functions required of the small farmer's team, make its adoption as a substitution for horses and mules a mere visionary scheme, essentially self-destructive.

W. K. MCCOY.

Gum Spring, Va.

Transporting a wounded horse on the Marne front

Arrival of an ambulance at the horse hospital

Horse Surgery at the Front

Field Hospitals for the Treatment of Sick and Wounded Animals

TIME was when, in making war upon what we must now recognize as an altogether trivial and vastly inefficient scale, a very slight injury to horse or mule was ground for his retirement from the service, either by infliction of the death penalty or by the less severe punishment of abandonment. Even as late as 1870, when Europe was last the scene of conflict between first class powers, human surgery was in a very elementary condition as compared with its present high estate, and of animal surgery next to nothing was known or cared. Horses were plentiful, and to cut the Gordian knot presented by a gunshot wound in an equine flank or leg with the aid of a firing squad and a few well chosen words about putting the poor brute out of his misery was alike cheaper and easier than to attempt its unraveling by any method calculated to restore the unfortunate animal to a state of usefulness.

Today the horse has established his claim to better consideration. We read on every hand of the motorized artillery, motorized infantry, motorized transport, we are told that during the great German withdrawal of last spring cavalry action took place for the first time since the Boche dug himself in after the Battle of the Marne, and from all this we are perhaps prone to conclude that in this war the horse plays little part. But nobody who has been near the front, nobody who has seen the systematic fashion in which British and French agents have been combing over our horse markets for three years past, could possibly share this misconception. In face of the incalculable enlargement of the whole scheme of warfare, the internal combustion engine has been powerless to displace the horse, powerless to do anything more than fill the great gap left between the supply of animals and the demand for power. Like everything else, horses and mules are found in this war in numbers never before approached.

And, as it has been necessary to exercise greater and greater scrutiny of resources in every direction—as it has been found imperative that an ever increasing percentage of the wounded men be restored to a condition permitting them to return to service, that every bit of metal be recovered and used again and again, that guns and lathes, the machinery of destruction and construction, be kept from the permanent scrap heap by every conceivable means—so, too, it has been essential that the ultimate pound of energy be obtained from every animal, that no mount or beast of burden be permitted to go into the last discard until every expedient to save him has been exhausted. For horses are scarce; no longer can the army chief shoot them or work them to death or turn them off with calm confidence that plenty more are to be had. Rather he must conserve them in every possible way; and so we have the field hospital for horses, illustrated on this page and on our cover.

Veterinary work near Monastir

The first adjunct of an ordinary hospital, the avenue through which it is supplied with its raw material, is the ambulance. Now a wounded horse or mule is just like a wounded man; sometimes he can proceed to the nearest relief station under his own steam, and sometimes he must be carried to the operating table. So connected with the horse hospitals at the front we find, sure enough, special horse ambulances. These are hardly so efficient as the more accustomed conveyances for human soldiers, in that the bulk of a horse, and the equine tendency to signalize all physical or mental anguish by means of flying hoofs, make it possible to accommodate but one passenger per trip. But wounded horses are not brought out of such desperate places as are wounded men, nor in such quantities; so this drawback is seldom found to be a serious one.

Once delivered to the hospital and turned over to the doctors, the first consideration is how the horse will behave under whatever treatment his injuries may call for. In the case of human patients this question is disposed of by the use of anesthetics. But a horse would kick up quite as much fuss at being chloroformed as he would at being operated upon; and besides, it is not customary to consider his feelings quite so carefully as those of a man. So he is tied up in such a manner that he cannot kick and cannot jerk the affected region away from the surgeon's hands, and the work of patching him up proceeds. If the reader will but reflect that even so simple an operation as shoeing gets upon the nerves of many horses to the extent of making it necessary to restrain them, he will realize that it is not always a simple matter to render a horse sufficiently helpless so that knife and needle may safely be used upon him.

No exact statement can be made as to the scope of the operations which may be performed successfully upon the patients of this equine hospital. The same difficulties that make it the custom in civil life to shoot a horse with a broken leg are met at the front. The only difference is that here the value of a live animal is so much greater

Shoeing a fractious horse at the infirmary

Treating a victim of mange

In the Oise district; preparing to treat sore eyes

Doctoring a wounded artillery horse in Albania

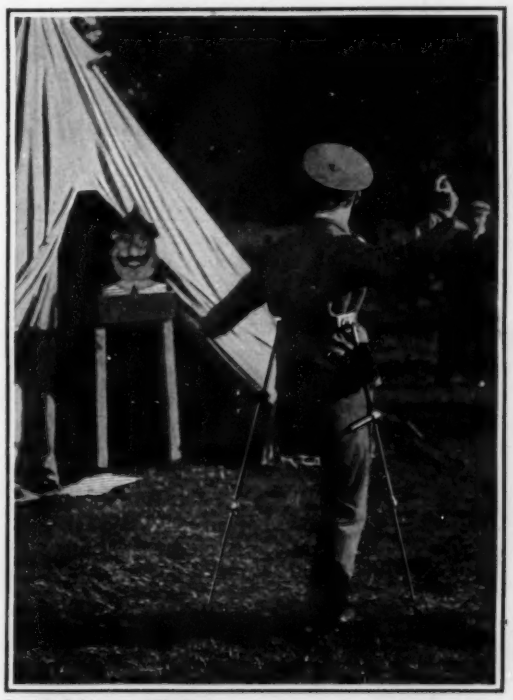
and the technique of treatment so much a part of the day's work that means can profitably be employed for saving him and hastening his recovery which ordinarily would cost too much in labor and expense. Still, as our pictures would indicate, the big part of the work done in this hospital must necessarily be in connection with flesh wounds, and it is in the means for successfully coping with these and preventing infection that the novel service has made its greatest strides.

Just as is the case with the human sufferer, a horse is not ready for discharge immediately upon the conclusion of the operation. A period of convalescence follows, during which the wound must be kept under observation, maintained in aseptic condition, etc.; and as one of our illustrations indicates, the processes and tools used here are substantially the same as those employed for the analogous work upon men. Further, if the nature of the case so demands, measures for restoring the patient's strength to normal are likewise in order, so that in this as in the more accustomed variety of hospital, the convalescent ward is a feature.

It may be pointed out that the work of the regular field hospital is not confined to cases of actual wounding. Men get typhoid in spite of every possible precaution; exposure leads to pneumonia or the development of constitutional disorders; dysentery and other digestive or nutritive troubles will occur in the best regulated armies. All these must be taken care of in the hospital. The boast that death from preventable causes not directly connected with wounds received in action has been practically eliminated from the modern army is made possible first of course by prevention measures, but second only to these by the excellent hospital facilities which cure a sufferer instead of leaving him to die in his tent. So, too, horses will get the mange, will come down with one or another of the epizoötic or casual ills to which horseflesh is heir. These incidents furnish a secondary field of activity for the "horse-pital," as Tommy Atkins would undoubtedly dub it were it not that his normal pronunciation of the word debars him from this pleasantry, and a field little if any less in importance than the more spectacular one of repairing the damage of actual wounds.

Crutches Which Are Always in Place But Never in the Way

THE large number of crippled soldiers in England has caused much attention to be directed to the subject of crutches, for it is the first duty of everyone to do everything possible for these unfortunates. Already, much has been accomplished along this line, and recently there has been introduced a novel belt crutch which is a vast improvement over the conventional types. The belt crutch, which is depicted in the accompanying illustration, consists of a Sam Browne belt and a pair of legs. The latter are made of telescoping lengths of steel, adjustable to any height, and are fitted to socket plates of aluminum. The socket plates, in turn, are mounted on a heavy leather belt, so that the crutches are always ready for instant use. It is said that the user is able to sit in a vehicle or at a table in comfort, and his arms are free for other uses. Indeed, he can forget the crutches, yet the moment he wishes to stand they are ready for use. Another feature is that the crutches can be arranged to support the user in a standing position, allowing free use of the arms as proved in the illustration, where the Tommy is amusing himself by pelting the Kaiser's effigy. This man is far removed from the old necessity of choosing at every turn between the use of his arms and that of his legs.



Copyrighted, International Film Service

By means of these newly-invented belt crutches the user has full use of his arms

A Field Kitchen Which Serves Three Hot Meals a Day to Two Thousand Men

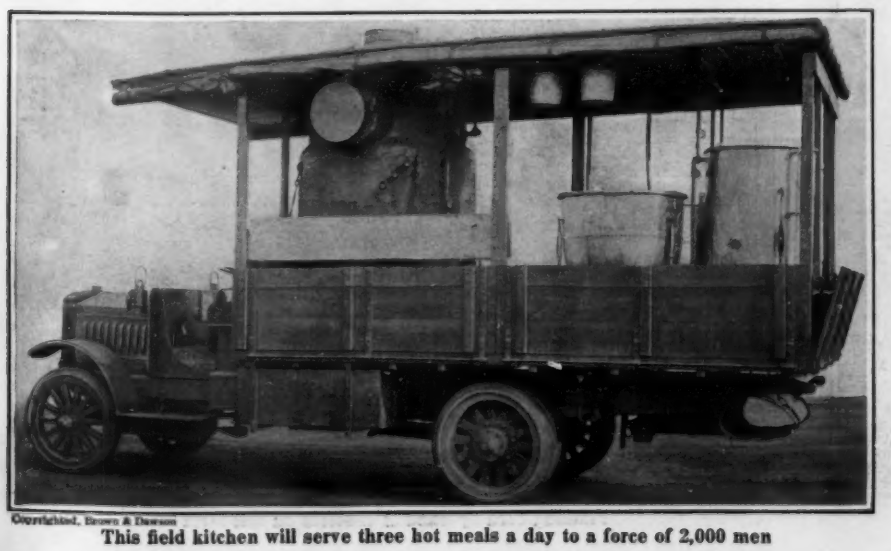
A NEW type of mobile army kitchen was demonstrated recently at New Haven, Conn., on Yale Field. Seventeen hundred and fifty men of the 102d Infantry were fed in less than an hour. The new kitchen will serve three hot meals a day to a force of 2,000 men, and provide enough coffee for 1,000 men every ten minutes.

The Taft Army Field Kitchen, as the unit has been christened, is practically a steam hotel kitchen mounted on a motor truck. It is the idea of J. C. LaVin, manager of a well-known hotel of New Haven. Associated with Mr. LaVin in the development of the field kitchen were C. M. Bradford, who supplied the motor truck chassis on which the unit is mounted, and H. D. Baldwin, who built the body. The idea of building a really efficient army kitchen came to Mr. LaVin during a visit to the Plattsburg Camp of 1916. The wasteful and unsanitary methods of food preparation which came to his attention caused him to devote his knowledge and skill to the building of a model mobile kitchen.

The latest army kitchen consists of a 10-horse-power steam boiler, two 90-gallon stew, soup or pot-roast kettles, and two 50-gallon coffee urns. The kettles and urns are heated both by steam jackets and by live steam injection. At the demonstration at Camp Yale coffee was boiled, from dead cold, in less than six minutes. So compact and well planned is the arrangement that the Taft kitchen, with two cooks, displaces two company kitchen units of eighty men and forty horses. Two of these mobile units will feed a full regiment, either in camp or on the march. Being capable of a speed of almost fifteen miles an hour, the unit can precede its battalion on the march, cooking a meal on the road, and be ready to serve hot food immediately the battalion halts. When the troops entrain the kitchen is put on a flat car and goes right on cooking.

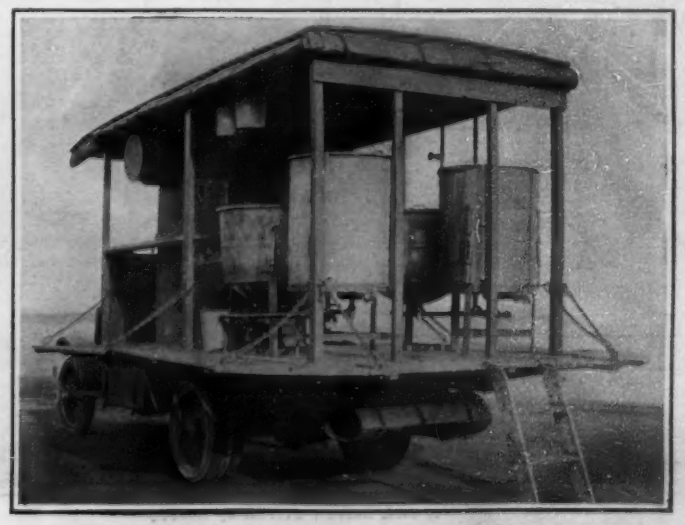
There is another way in which the Taft Unit is an immeasurable improvement over the old methods, namely, in the cleaning of mess kits after meals. Anyone who has ever seen a company of soldiers all trying to clean their kits in three iron kettles full of grease, pieces of unused food and a little warm water will realize what a blessing unlimited boiling water and live steam will be.

It is planned to add to the equipment a six-kilowatt generator to be operated by the motor truck engine. This would furnish sufficient current for a 40-candlepower lamp in the tent of each soldier, for a 12-inch searchlight, and for a field wireless station, adding that much to the usefulness of the unit.

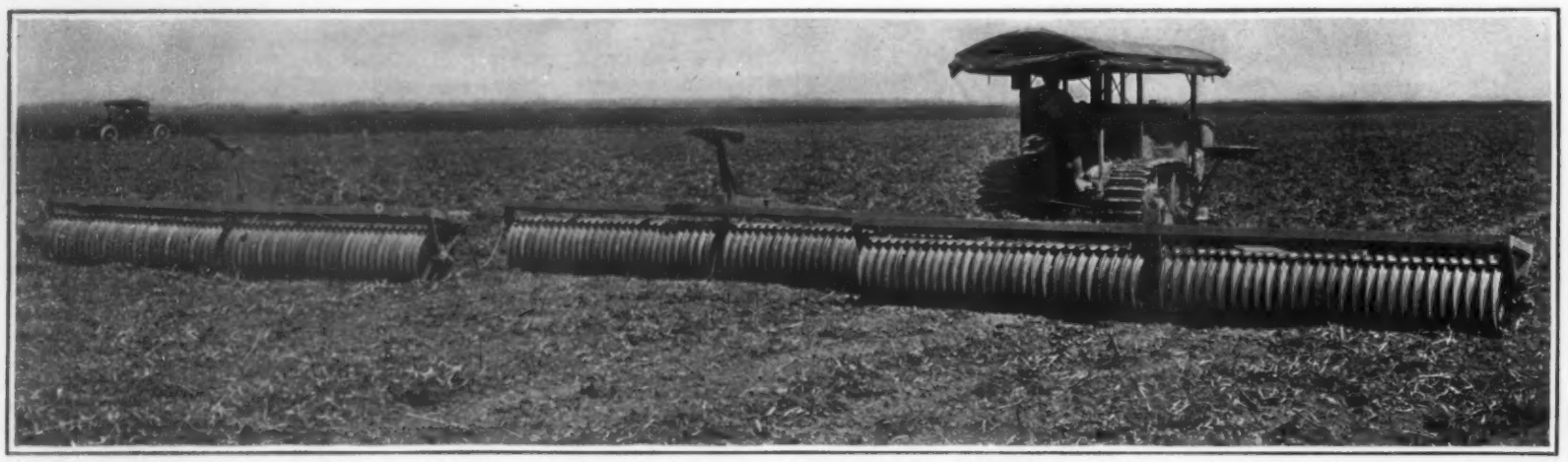


Copyrighted, Brown & Dawson

This field kitchen will serve three hot meals a day to a force of 2,000 men



Rear view of the Taft Army Field Kitchen



One tractor pulling 42 feet of corrugated steel roller in a California bean field

Mobilizing the Farm Machinery

By Arthur L. Dahl

THE farmer has come into his own. His real worth to the Nation is being appreciated, and our urban citizens are revising their opinions of their rural kindred, and are looking to the country people to feed them and the entire world in these perilous war times. A tremendous task has been given the farmers of the United States, and they are responding nobly, but many difficulties confront them in their effort to produce the maximum crop this season. Nature must coöperate if even the slightest crop is to be secured, and in many sections of our country natural conditions have been against a good growing season. Spring was late, and thousands of acres of winter-sown grain fields had to be replowed in the spring and resown. With the call to arms of many of the Nation's young men, and the feverish activity in the industrial centers, with their constant call for fresh laborers, the farmer found it difficult to secure the help he needed. And it was in just such a crisis as this that the difference between the old-fashioned farmer and the modern efficient farmer was displayed. The former was typified as the "Man with the Hoe," while the latter may be said to be the man with the auto. Animals, particularly horses, have always been a necessary part of farm equipment, but the farmer and his sons or hired helper toiled as arduously as any of his horses, in plowing or cultivating or harvesting the grain.

But the modern farmer would rather use his head than his muscle, and he was quick to acquaint himself with the wonderful development along the line of farm machinery. The untiring energy of the gasoline- or distillate-driven machine has been made available for almost every department of farm labor, and while human labor will never be entirely dispensed with, a well equipped farm, or ranch, can be handled with but a fraction of the help needed in earlier days.

With a modern tractor to take the place of horses as the motive power, and with plows, harrows and seeders hitched tandem, the field can be traversed and in one operation the soil plowed, leveled and planted to seed with a celerity undreamed of many years ago. In the old days, man and beast had to toil from sunup to sundown merely to plow a small tract of land; the same ground had to be traversed to prepare it for the seed; and the methods of planting were both toilsome and unscientific. Under modern conditions, a crew of two or three men can plow and prepare for crops from twenty-five to thirty-five acres a day, and with little fatigue.

When the grain is ripe the reapers are operated in the same manner, a path of 25 feet or more being cut at one time as the engine proceeds. Automatic rakes gather up the grain, and at one operation the wheat is threshed and sacked and made ready for the miller.

Loading hay by machinery

Picking 260 acres of corn in 17 days

Even where tractors are not used the modern farmer has much easier conditions to work under than his father. The corn planter drawn by horses has displaced the old method of hand dropping and hoe covering, the seed now being planted with great rapidity and at such regular intervals that the rows may be cultivated in either direction with equal facility, the cultivation itself being done by a riding plow, which more effectually shields the young plants than was done by any farm hand working with the old-fashioned hoe. The combination cutter and binder is driven into the field when the corn is ripe, and in one hour does the work which formerly required a day for one man to perform with the old corn knife. The corn, stalks, ears and all, is thrown into a machine and in a moment reappears, the ears cleanly husked and the stalks cut into fodder for the stock. Instead of one man shelling six bushels of corn in a day, the modern machine shells it at the rate of a bushel a minute, and all man has to do is to keep his hand on the lever and direct the operations.

Mowers, tedders, rakes and stackers have revolutionized the making of hay. Formerly it required the work of one man for 11 hours to cut and cure a ton of hay. Now the same work is done by one man in an hour and a half.

Machines have been devised for almost any and all purposes connected with farming. The potatoes are dug by ma-

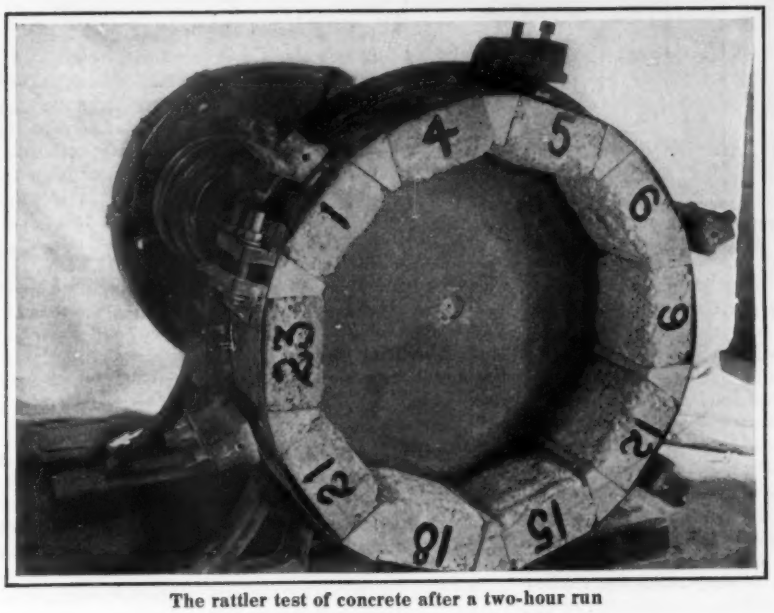
(Concluded on page 279)

A disk harrow driven by horses

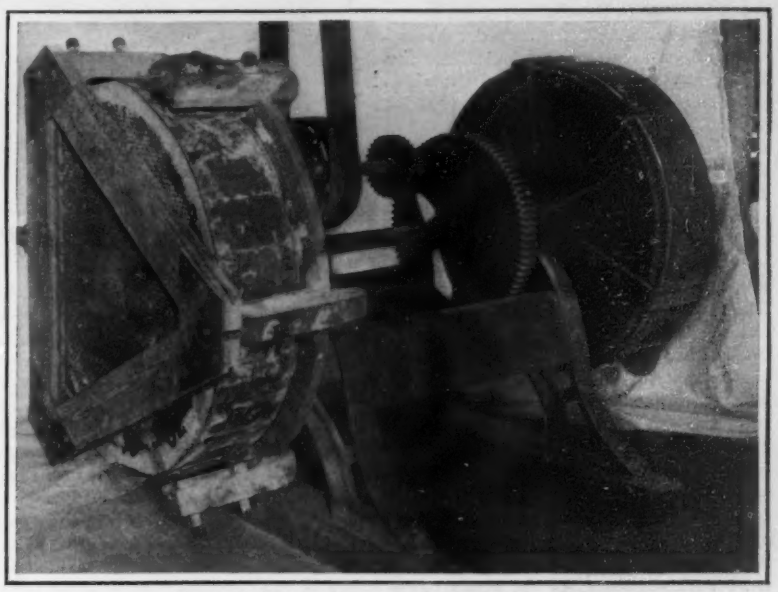
Planting corn by hand is obsolete on this farm

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



The rattler test of concrete after a two-hour run



General view of the rattler for testing concrete

A Merry-Go-Round for Testing Concrete

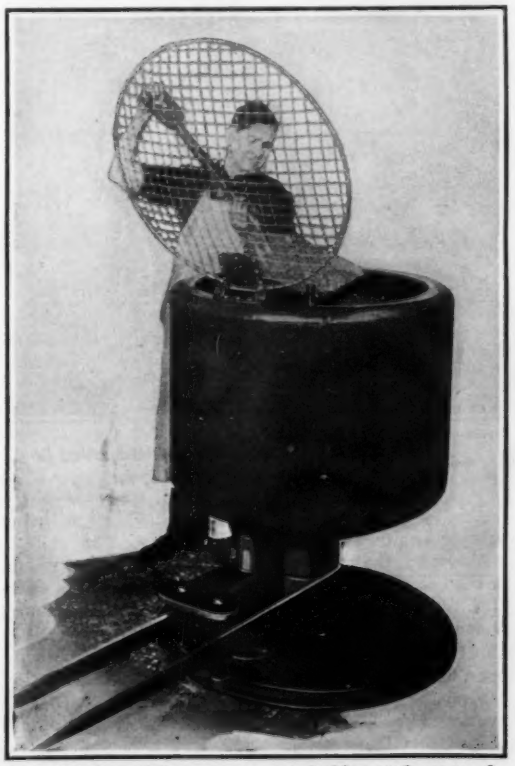
THE accompanying illustrations show a "rattler" apparatus employed for wear tests of concrete in the structural materials laboratory of the Lewis Institute of Chicago. Prof. D. A. Abrams, under whose charge this apparatus has been developed, points out that the extensive used of concrete as the wearing surface of roads and pavements has given renewed interest to experimental studies of the wearing resistance of this material. When weather resistance and structural stresses are properly provided for, the life of a road will depend upon the wearing resistance of the material of which it is built.

Wear, in the sense in which the term is here used, results from combinations of stresses such as abrasion, impact, bearing and crushing. Wearing resistance is therefore a function of the hardness, toughness, brittleness, etc., of a material. In the case of homogeneous materials, such as natural rocks, it may be satisfactory to study these individual properties; with a material of the nature of concrete, however, it is preferable to study the wearing resistance directly, without reference to the values of the more elementary properties. It is for this purpose that the rattler pictured has been devised.

The testing process consists in exposing the surface of the material to wear; and the manner of accomplishing this is to line a rotating chamber with blocks of concrete, and to fill the chamber partly with abrasive material, which is thrown heavily and repeatedly against the testing surface as the chamber turns. In the design shown, the test pieces consist of blocks eight inches square and five inches thick, wedged in around the perimeter of the drum as shown in the photograph. The decagon thus formed presented a nearly continuous inner surface of diameter 26 inches. During the tests, the front of the chamber is closed by a heavy wire screen. The abrasive charge consists of 200 pounds of cast-iron sphere—about 133 spheres, of diameter 1⅞ inches, and 10 sphere 3¼ inches through. The rattler is ordinarily put through 3,600 revolutions at a rate of about thirty per minute, so that a test lasts about two hours. It is said that the best results are obtained by reversing the machine two or three times during the course of the test. Each block is weighed before and after going through the mill, and the wear expressed in terms either of percentage of weight lost or of wear in inches. In comparing concrete of widely differing characteristics, or in referring concrete to other materials, the latter method is found preferable.

About two hundred blocks of concrete have thus far been tested in this machine, the tests having been mainly designed for the purpose of studying the action of the rattler. The weight of the shot to be used, the proportion of large and small spheres, the rate and number of revolutions, and various minor technical points connected with the mechanism of the tests, have been carefully considered. The loss in weight due to the test has varied from eight to twenty-five per cent.

The advantages of this machine are that the treatment approximates that of service, that the test piece is of the usual form and of sufficient size to make possible the use of representative samples, that the test pieces are convenient to make, store and handle, and that testing costs are not excessive. It is pointed out that tests may be made on sections of concrete cut from roads which have been in service, and that other paving materials such as brick and granite blocks may be tested in the same way and with equal satisfaction.



Reclaiming oil from waste metal chips at the rate of 500 gallons per day

The latest wrinkle in electric fans

Reclaiming Oil

IN most machine shops one will find bins of steel chips, shavings and other fragments of metal that result from drilling or lathe work, and anyone who examines this waste will observe that it is heavy with oil. The small plant manager would laugh at you if you suggested that this valuable material might be reclaimed, but to the manager of an extensive plant, it would be no laughing matter. With the increased prices demanded for every material that enters into a shop, the saving of all reclaimable waste is a matter for serious consideration by all concerned.

The bigger the plant, the more efficiency is shown in taking care of the leaks. This is demonstrated in one of the huge Detroit automobile plants, which reclaims 500 gallons of perfectly good oil every day that the shops are in operation.

Machinery for this purpose has been installed, and the principle on which it operates is simple and well known, centrifugal force being employed to separate the oil from the metal fragments. A battery of 12 metal cylinders may be found in the plant, each containing a somewhat smaller cylinder which, filled with the oil-laden chips, is caused to whirl rapidly by a belt extending to the base of the machine. This inner cylinder is perforated, the holes being so small that the metal chips are retained while the oil is thrown out as the separator revolves.

The results of this apparatus are startling; no less than one-third of the amount of cutting oil used in the plant being saved. The fluid employed to cool the tools that cut and drill the steel parts of the automobiles is composed of many ingredients. It looks like milk but is hardly as mild, for oleic acid, machine oil, caustic soda, denatured alcohol and kerosene enter into it. With 1,300 gallons used every day, the saving of 500 gallons cuts down the expenditure for this commodity to an extent that runs into big figures at the end of the year. While to the initiated this prodigious consumption of lubricant material will be a matter of course, it may astonish the layman. The latter may attain a better comprehension of the matter if he reminds himself that oil is piped through this plant like water in a house, and that 150 men are employed for the sole purpose of seeing that the thousands of machines are properly oiled.

A Fan That Makes No Wind

AN interesting development of the electric fan is a series of blades formed on new lines. Instead of the propeller shaped blade, the present device is composed of sheets of metal rolled in a cylindrical shape, one cylinder being within the other. The action of this fan when attached to a motor in the ceiling is to draw the air upward with a gentle draught, instead of blowing it violently downward from the upper part of the room. The inventor claims that this results in far more effective cooling, as the heated air is nearest the ceiling, while the cool air is near the floor. Hence to draw the cool air upward gives the best results. The action of the fan is so gentle that it does not tend to raise the dust from the floor, yet it effectively circulates the air and reduces the temperature in short order.

It has been tried out with success in restaurants and offices and is adapted to factories, halls and other places where perfect ventilation is required.

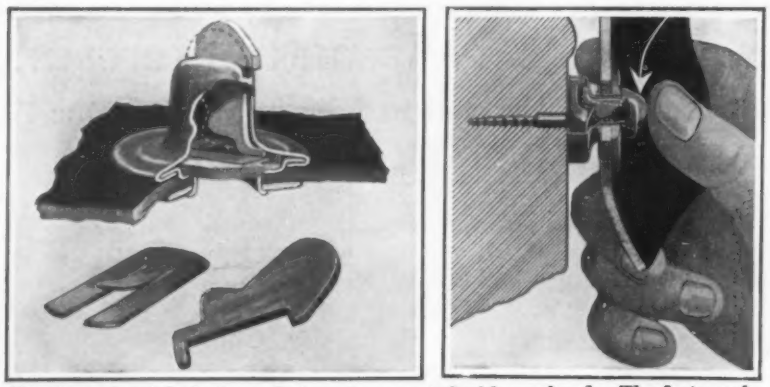
Improved Curtain Fastener for Automobiles

WHILE we have ceased to look for any really fundamental improvements in motor cars, there are a thousand-and-one refinements that can be made and are being made in the lesser details which mean so much to the comfort of the owner.

An improvement of this order has recently been made in the devices for fastening curtains, and of course, this improvement is applicable to other types of vehicles as well. Our illustrations show two forms of the fastener: One of the clinch type which is secured to the curtain fabric, while the other is fitted with a screw whereby it may be fastened to the frame of the vehicle. The fastener is provided with a spring latch which fits over an eyelet in the curtain and thus provides a positive lock. The dotted lines show how the latch is pressed back to unlock the fastener. As this fastener does not depend upon spring friction to hold it fast, there is no danger that the curtain will blow open. To unfasten the curtain, it is merely necessary to grasp it with the hand, push the catch with the thumb of the same hand and raise the curtain. This, it will be seen, is a one-hand operation and can be done from any position.

With previous types of fasteners it has been necessary to punch holes in the curtain fabric for the prongs of the eyelets. This has resulted in a tendency to tear the curtain at the hole. With the eyelet we illustrate, there is no such tendency for the strain never comes in the hole in the gooda. The fabric is firmly clamped between the eyelet and a washer.

In applying these fasteners, they can be placed and operated in any position because they are uniformly round, whereas the older fasteners have to be carefully alined, otherwise the curtain will be wrinkled and torn.



New type of curtain fastener that can be operated with one hand. The fastener is broken away to show details of the latch

Coal Gas as a Fuel for the Motorcycle

OWING to the scarcity and high cost of gasoline in Great Britain, much interest has been shown of late in the operation of motor vehicles on coal gas. Experiments have been carried out with motor busses equipped with large bags filled with gas used in place of gasoline. However, it appears that the scheme is not new, and that a decade or so ago the same idea was entertained, then tried out, and finally abandoned.

Typical of efforts to replace gasoline with coal gas is the apparatus shown in the accompanying illustration, which has been constructed and tried out in England. The gas bag, it will be noticed, is fitted with metal ends which are supported by an iron framework. The gas is taken from the bottom of the balloon-like bag and brought to the engine in much the same manner as gasoline. The metal ends, it appears, serve to preserve the shape of the gas bag even when the motorcycle is going at a fair rate of speed, while the heavy cord netting prevents the bag from being overblown. Despite the size of the bag, it is claimed that packages can be carried on the side car as usual.

The cost of running on coal gas is estimated at about two cents for ten miles. The motorcycle shown has been driven over 100 miles with the coal gas fuel, and is said to work satisfactorily.

Copyrighted, International Film Service

It costs about two cents for every ten miles to operate this coal gas motorcycle

An Automobile Fender Which Wraps a Pair of Arms About its Victims

PROMPTED by the large number of accidents which occur each year in the busy thoroughfares of all cities, A. Loscalzo of Hoboken, N. J., has invented and perfected a most ingenious form of fender which is applicable to vehicles in general and to automobiles in particular. His fender is of such construction that when the victim is struck he is immediately caught and held in place by a pair of arms which wrap about him, while a reinforced curtain is dropped in front of the wheels so that he cannot come under the vehicle.

The main members of the new fender are the bumper proper, a pair of arms, and a reinforced curtain. Normally, the arms are held in place just beneath and a trifle to the rear of the bumper. Each arm, it will be noted in the accompanying illustrations of the automobile-type fender, is made up of two sections hinged together and arranged to telescope when the apparatus is inactive. When telescoped the smaller section is held in place against a spring pressure which has a tendency to push it out; furthermore, the hinge is provided with springs which cause the smaller section to swing round when released. Combined in a pair, the arms when operated release their smaller sections which then swing in toward each other so as to form a triangular enclosure, which is freely pivoted at the apex. The latter feature makes it possible for the arms to wrap about the victim no matter whether he is to the left, at the center, or to the right, just so long as he comes in contact with the bumper member.

Normally, the arms are held in place by latches which, in the case of the electrically-operated fender, are operated by solenoids. When the bumper member comes in contact with the victim, it is sufficiently depressed to affect the electric circuit containing the solenoids; whereupon the arms are released and thrown about the victim. Meanwhile the curtain, which is preferably included in another circuit, is released as the driver applies his brakes.

The curtain, which is reinforced by a pair of telescopic tubes and flat bars, can also be operated by pressing a button on the steering column of the car, so that in the case of children the driver can let down the curtain in time to save them. Since the bumper is generally too high to come in contact with them—and even if it did the arms would be too high to be of much value—the curtain must be mainly relied on for children. This is also true in the case of stray dogs and other animals, who are protected because the curtain comes down to within an inch or two of the road.

There are a number of ways in which the fender may be applied, according to the inventor. It can be mechanically or electrically operated; and the arms can be held inactive by different methods, such as a governor device which only closes the circuit when the car attains speeds above a certain limit, by a contact-making device on the brake pedal, and by a manually-operated switch. In any event, some method can be followed so that the device is ordinarily inoperative; otherwise one can well imagine the dilemma of a driver using such a fender in a crowded ferry-boat, when a vehicle in front happened to back up slightly into the bumper. In recent tests the fender has been tried out many hundreds of times, at varying speeds. In one instance the fender struck a man while the automobile was traveling at 27 miles per hour, and it is said that the victim was readily and safely picked up by the arms, which, being heavily upholstered, cannot cause injury.

The Story of the Bristle

IN the United States a hog hardly lives long enough to get through being a pig before he becomes pork, bacon, ham and tenderloin. In the process, of course, he sheds his bristles. These are so soft and short that few of them get into brushes, which constitute really a high toned use for bristles. Instead they are employed as curled hair for the rather plebeian purpose of filling automobile cushions, and they even get into mattresses sometimes, working through the ticking and pricking sleepers to unpleasant dreams.

The people of Russia are the true epicures of the world regarding a pork diet. They enjoy and demand their pork well ripened, and to be truly appetizing they feel that it should be at least three or four years growing. Hogs which produce, from such a period of foraging in fields and forests, the delicious pork eaten by the Russians, grown at the same time the best bristles in the world for the brush maker, splendid long stiff ones that are used for all sorts of long brushes.

Northern Germany gives us bristles similar to those of Russia. Belgium and France grow shorter and finer bristles than Russia, from younger hogs, but of splendid quality. These are the sort used in toothbrushes, artists' brushes, and many similar lines. Of late years brush manufacturers have even gone to China for immense quantities of bristles, and as nearly all hogs there are black, that is the color of the Chinese bristles. Everyone has read Charles Lamb's account of the discovery of roast pig in China through the finding of one in a burnt house, and of how thereafter a house was burned whenever the delicious roast was wanted. As long bristles of good stiffness come from China, it is fair to assume that its people like well matured pork.

Bristles before they can be put into brushes receive much attention from the brush maker. Washing with soap and water, sorting by colors and grades, separating of lengths, remixing to get stiffness, are all details demanding the attention of expert workmen.

Iron Crucibles Instead of Platinum

PLATINUM is more expensive now than at any time in its history and yet it is regarded as an indispensible medium as a crucible for use in analyzing certain compounds. It is, however, possible to dispense with it in analyzing ferro-silicon, an important alloy used in making steel. According to Dr. Herwig, in a German technical paper, iron crucibles can be used for this purpose if, instead of the usual carbonate of soda and potash method, sodium dioxide is used in the ignition mixture. Great care must be taken to reduce the ferro-silicon to as fine a powder as possible, to remove all coarse particles, and to mix the powdered silicon thoroughly and very uniformly with the dioxide, as otherwise dangerous ebullition might take place, which would nearly empty the crucible and cause spattering.

With the arms in their normal position. Arms and curtain after being released. What happens when the fender strikes the victim.

Three views of a recently-invented automobile fender, which protects the pedestrian against all hazard

FOREIGN COMMERCIAL NOTES AND QUERIES

The SCIENTIFIC AMERICAN has always enjoyed a wide international circulation. Its voice is heard in the remotest corners of the earth. Now that American manufacturers have been stirred to the advantages of international expansion we are anxious to do our part in bringing American products into foreign markets. Hence this department has been established to pave the way for American trade expansion to all quarters of the globe.

Those who are interested in the trade opportunities listed in this column, can obtain the names and addresses by complying with the following simple rules: 1. Write only one inquiry on a sheet. 2. Always give the serial number. 3. Write on your own business letterhead. The SCIENTIFIC AMERICAN assumes no responsibility for the financial standing of concerns or individuals. Address all communications to the Query Editor of the SCIENTIFIC AMERICAN, Woolworth Building, New York.

665.—A firm in British East Africa is in the market for leather and canvas boots and shoes of all kinds for men and women, about $5,000 worth of which can be used annually. Payment will be made by sight draft with bill of lading attached. Quotations should be made in English sterling. Goods should be packed in extra strong cases with waterproof lining and wrapping. Correspondence may be in English. Reference.

666.—A man in India wishes to receive catalogues of steam engines, oil-mill machinery, and button-making machinery.

667.—A firm in Spain desires to represent American manufacturers and exporters of general hardware and carpenters' and workshop tools. Correspondence should be in Spanish. References

668.—A company in Russia wishes to secure an agency for the sale of wood-cutting saws driven by machinery, files, and other tools and implements. References.

669.—A firm in Cuba desires to secure an agency, on a commission basis, for the sale of building materials and hardware, such as white and yellow pine, floor tile, roofing tile, cement, roofing paper, window glass, locks, etc. Correspondence may be in English or Spanish. Two members of the firm are at present in the United States, with whom interested firms may communicate. Reference.

670.—A company in British East Africa is in the market for all kinds of table and household glassware, about $5,000 worth of which can be used annually. Payment will be made by sight draft with bill of lading attached. Quotations should be in English sterling. Catalogues, prices, etc., should be submitted. Goods should be very carefully packed in extra strong cases or crates. Correspondence may be in English. Reference.

671.—A firm in Brazil wishes to represent American manufacturers and exporters of cotton, woolen, and silk goods; textiles; leather and leather belting; iron and steel products, such as bars, rods, sheets, pig iron, etc.; machinery; railroad materials; oils, paints, and colors; drugs and chemicals; paper and rubber goods; and textile machinery. It also desires to act as agent for American steamship lines and shipbuilders. Correspondence may be in English. References.

672.—A company in British East Africa desires to purchase yellow and blue mottled washing soap, put up in 2½-pound bars and packed in boxes containing 112 pounds. Present cost of this soap in Africa, duty paid, is about $6 per 112 pounds. From 40 to 50 tons of this soap can be used annually. Payment will be made by sight draft, with bill of lading attached. Quotations should be made in English sterling. Goods should be packed in extra strong cases with some kind of waterproof wrapping. Correspondence may be in English. Reference.

673.—A firm in Spain is in the market for drugs and chemical products. Quotations should be made f. o. b. New York, Galveston, or New Orleans. Correspondence may be in English. References.

674.—An agency is desired by a man in England for the sale of lumber in South Africa, also thin-dressed lumber for the English market, the lumber to be finished ⅛ to ¼ of an inch in prime quality red gum, quartered and plain oak, maple, birch, black walnut, etc. Fine sawn, undressed lumber of this kind might also be considered. Quotations should be made f. o. b. New York. References.

675.—A manufacturer in Spain wishes to represent American manufacturers and exporters of printing machinery. Quotations should be made f. o. b. New York. Payment will be made against shipping documents. Goods should be packed in strong wooden boxes. Correspondence should be in Spanish or French. References.

676.—A man in France desires to purchase sawmill machinery, especially circular; also planers suitable for use with resinous pine timber. Later on he might consider an agency proposition for the sale of such machinery. Quotations may be made f. o. b. New York. Payment will be made by cash against documents. Correspondence should be in French. Reference.

677.—A firm in British East Africa wishes to buy bicycle tires 28 by 1½ inches, with a straight ribbed thread running with with the tire; 4,000 to 5,000 of these tires can be used annually, as well as inner tubes for same. They are now being supplied for about $1.60 f. o. b. ship London. Payment will be made by sight draft with bill of lading attached. Quotations should be in English sterling. Goods should be packed in extra strong cases with waterproof wrappings. Correspondence may be in English. References.

678.—A business man in Guatemala is in the market for apparatus for distilling alcohol, whisky, brandy, etc., especially apparatus in which porcelain is used as much as possible. Quotations should be made f. o. b. New York or New Orleans. Payment will be made by cash against draft with shipping documents. Correspondence may be in English, but Spanish is preferred. Catalogues and prices should be submitted for such apparatus of small or medium capacity. Reference.

679.—A firm in France desires to represent, on a commission basis, American manufacturers and exporters of print paper and good quality writing paper. It also will purchase large quantities of this paper. Cash will be paid. Correspondence may be in English. References.

680.—An agency is desired by a man in England for the sale of black bars, shafting, and wire rods. Quotations should be made f. o. b. New York. Payment will be made against bill of lading in New York or London. References.

681.—A firm in Italy desires to purchase large quantities of needles, pins, cotton thread, thimbles, spools, and awls with wooden handles, for fitting out mending kits for soldiers. The firm also wishes to buy cheap iron scissors and pocket combs, also to be used in kit. Correspondence should be in French or Italian. Reference.

HARNESSING *the* MOUNTAIN
to Conquer the Mountain

THE mountains, for years almost impassable barriers to transportation, have been made to yield their limitless store of energy to the service of man.

The tremendous forces of mountain torrents have been fitted to the yoke of achievement and now furnish the power that hauls the great all-steel trains of the ***"St. Paul Road"*** across the backbone of the continent — 440 miles through the Belt, Rocky and Bitter Root Mountains. An additional 211 miles is being electrified through the Cascade Mountains in Washington.

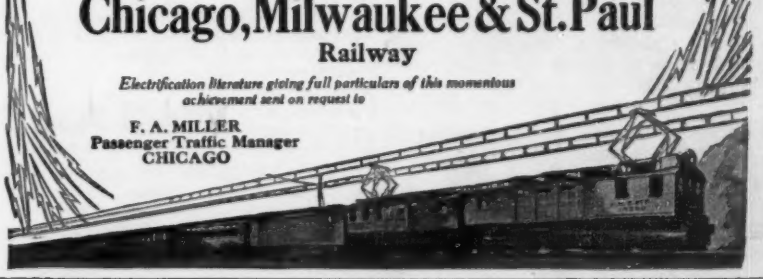
When next you journey to the cities of the Pacific Northwest travel electrically on either of those famous trains ***"The Olympian"*** or ***"The Columbian."***

Mountain travel without cinders — without jar or grinding brakes. Snow-clad vistas unobscured by trailing smoke — via the

Chicago, Milwaukee & St. Paul Railway

Electrification literature giving full particulars of this momentous achievement sent on request to

F. A. MILLER
Passenger Traffic Manager
CHICAGO



Free Trial

Piedmont Red Cedar Chests protect furs and woolens from moths, mice, dust and damp. Finest Xmas or wedding gift.

15 days' free trial. Postpaid free.

New Low Factory Prices

Write for new catalog with reduced prices.

Piedmont Red Cedar Chest Co. Dept. 92. Statesville, N. C.

TOY INVENTIONS

not yet placed with manufacturers may be profitably placed by

ROBERT TINSMAN
6 East 39th Street, New York City

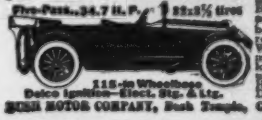
LEARN MILITARY FRENCH ON YOUR OWN PHONOGRAPH

or ours, with Disc Records, AT SMALL EXPENSE. French-English Military Manual by J. A. Picard of the French Army. Foreword by Maj.-Gen. Leonard Wood. Send for free circular regarding all languages. Cortina Academy of Languages. Suite 2221, 12 E. 46th St., N.Y.

Spanish-French-English-Italian-German

Driver Agents Wanted

Drive and demonstrate the Buda Car. Pay for it out of your commissions on sales. My agents are making money. Ships-to-agents proposition. Buda Cars guaranteed or money back. 1918 models ready. Write at once for my 48-page catalog and all particulars. Address J. C. Buda, Pres. Dept. 10 F M



115-in Wheelbase
Delco Ignition—Elect. Stg. & Ltg.
BUDA MOTOR COMPANY, Buda Temple, Chicago, Illinois

586.8 MILES OVER Chicago's Most Congested Streets in 24 Hours On High Gear

A Remarkable Feat Accomplished by a
STROMBERG-EQUIPPED
Stock Seven-Passenger Chalmers

March 26th, noon, a Stromberg-equipped stock Chalmers seven-passenger touring car—complete with standard body, top and full equipment—carrying four passengers—was started on a 24-hour run through the heart of Chicago's busiest traffic. 586.8 miles were traversed—with a perfect score. Every mile—all stops, all starts were made on high gear and high gear alone.

The Motor Was in Operation Every Second of the Time

in the "thickest" of Chicago's most crowded streets—criss-crossing the loop. Weather conditions were detrimental—cold-snowy-windy. Still the engine never faltered—never failed to respond instantly. Never was there a greater display of flexibility—of dependability. And with this splendid efficiency, there was a substantial saving in fuel—an average of 14 miles on a gallon of gasoline.

Write at once for free circular matter—and money saving facts. State name, model and year of your car.

STROMBERG MOTOR DEVICES CO. Dept. 1016
64 E. 25th St., Chicago

New STROMBERG Does it!
CARBURETOR

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of SCIENTIFIC AMERICAN.

Pertaining to Apparel

HAT-BRIM.—W. WOLF, care of Loewenthal & Marcus, 636 Broadway, New York, N. Y. The invention relates to women's hats, it comprises a covering made of two pieces fastened together at their outer edge, a flat filling between the covering pieces, and provided at the outer edge with a stiffening ring, stitches fasten the outer margin of the filling to the covering and the shaping ring inserted between one of the covering pieces and the filler.

GARMENT.—GRACE M. KIMBALL, 605 W. 144th St., New York, N. Y. The object of the invention is to provide a garment such as a chimese, skirt or petticoat, arranged to provide leg portions or drawers with a full skirt or petticoat effect and without marring the appearance of the lace or other trimming at the lower edge of the skirt or petticoat. In order to accomplish the result use is made of a band adapted to pass between the legs of the wearer and connecting the back with the front of the garment.

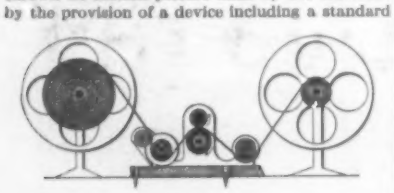
Pertaining to Aviation

AEROPLANE.—E. L. RUSSELL, care of the Russell Aeroplane Co., Great Falls, Mont. The invention relates to aeroplanes of the type having superposed planes of which the upper plane is provided with rigid upwardly inclined extensions projecting beyond the ends of the lower planes, ailerons hinged to the rear edges of the upwardly inclined extensions, a cable connecting the upper surface of the ailerons and extending across the top of the upper plane, an intermediately pivoted foot control bar, and cables extending from the opposite ends of this bar to the lower surfaces of the ailerons.

Electrical Devices

THREE-WAY PULL-CHAIN SOCKET.—J. F. MCCARTHY, 1892 2d Ave., New York, N. Y. The invention relates to electrical sockets particularly to a socket to be used in connection with a switch or another socket of a similar nature whereby the light connected with the socket may be turned on at one place and off at another. The object is to provide a pull socket which will dispense with one switch when it is desired to turn the light off and on at two different places.

MOTION PICTURE FILM CLEANER.—M. E. NOBLE, Elgin, Texas. The primary object of the invention is to allay the oil and grease thrown on motion picture films by the machines by the provision of a device including a standard



A VIEW IN SECTION LONGITUDINALLY SHOWING THE DEVICE IN OPERATION

having a lower roller carried thereby and an upper spring tensioned roller movable towards the lower roller, both of the rollers being wrapped with absorbent material between which the film is adapted to pass, the absorbent material being adapted to be removed as it becomes soiled.

SPARK PLUG.—A. J. DINKEL, Clarinda, Iowa. The invention relates to spark plugs for internal combustion engines, the general object being to improve the construction and operation whereby carbon or soot is prevented from collecting on the sparking points, one of these sparking points or electrodes being a freely movable body which is at all times maintained a constant distance from the fixed electrode for the purpose of maintaining the spark gap constant. Another object is to provide a cleaning device associated with the movable electrode for preventing the accumulation of soot in the shell of the spark plug.

SYSTEM OF RULING.—J. J. MCCARTHY, care of Edward E. Wheeler, Atty., Ouray, Colo. The patent relates to a printing system for ruled forms comprising a series of body units and a series of heading units, all of the units being of the same height and all of the body units having one dimension equal and varying in the other dimension by certain predetermined values, the units having elevated spaced printing ribs on their upper faces aliining when placed in register.

SHADE AND CURTAIN FIXTURE.—A. J. DINKEL and H. C. HARTMAN, Clarinda, Iowa. The invention relates to a combination fixture having telescoping rod sections and adapted to hold a shade and a curtain, spring means being provided for maintaining the telescoping sections in adjusted position on a window frame. A further object is to provide a holder constructed in a manner adapted to facilitate the placing and removal of the same and the convenient placing and removal of the curtain.

DEVICE FOR PREPARING INFUSIONS.—A. I. GONSALVES, care of Hotel Lafayette, New York, N. Y. The object is to provide a simple and inexpensive device particularly adaptable for preparing an infusion of coffee, the device comprises an outer spoutless receptacle to receive the matter to be infused and an inner receptacle having perforations in its sides and bottom whereby the infused liquid can be poured from the inner receptacle and the residue will be retained in the outer receptacle.

HAND-BAG AND SIMILAR ARTICLE.—T. R. WEIDEMANN, 93 Webster Ave., Jersey City, N. J. This invention relates to hand bags, pocket books, and similar articles its object is to provide an article arranged with a partition to divide a pocket into separate compartments, the partition being held at all times in middle position, to allow the user ready access to either compartment on opening the pocket. Another object is to decrease the bulkiness of the article.

SCAPULAR-RING.—A. H. KOPETSCHNY, care of Schwarz, Kerwin & Fauss, 42 Barclay St., New York, N. Y. The object is to provide a scapular ring normally resembling an ordinary signet ring but with a scapular concealed therein. In order to produce the result use is made of an annular band having a signet top provided in its upper face with a recess a cover hinged on the top and overlaying the edge of the wall at the time the cover is in closed position, a scapular plate concealed within the recess and mounted to swing on pintle of the hinge of the cover.

Of Interest to Farmers

DRAFT-BAR.—W. F. DUNN, Box 3, Talent, Ore. The object of the invention is to provide a draft bar more especially designed for use on harrows and other agricultural machines and devices, and arranged for being connected with a single team or as an evener for two teams employed for dragging the harrow over the field. Use is also made of a coupling device of special construction for connecting two bars with each other for use on harrows of any number of sections.

Of General Interest

LETTER FOLDER.—R. B. TAYLOR, Wilkie Saskatchewan, Canada. The invention has for an object to provide an arrangement which may receive a number of letters and hold them in proper assembled condition while the folder is in use or after the folder has been placed in a file cabinet. Another object is to provide an index tab and means for receiving transfer slips, by this arrangement loose letters may be held in the folder or assembled letters held therein by the slips.

SIPHON CREAM-REMOVER.—J. H. COURNYER, 122, College Ave., Oskaloosa, Iowa. The object of the invention is to provide a device in the nature of a siphon for removing cream by a simple and effective means, whereby the cream remover may be held firmly within the receptacle such as an ordinary milk bottle.

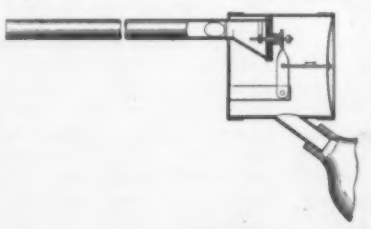
SPRING GUN.—J. H. MACLEAN, 305 East Ann St., Ann Arbor, Mich. The invention relates to a gun wherein spring controlled mechanism is provided for compressing a column of air to cause ejection of a projectile, and wherein means is provided in connection with the gun for preventing the discharge of the projectile from the barrel, thus providing for a report without the discharge of the projectile, the retaining means being releasable to permit discharge when desired

SHOE-STRETCHING TREE.—V. BENEDETTI, 1 Abbott Bldg., Palisade, N. J. Among the objects which the invention has in view are: to provide a device for stretching the leg of a shoe without changing the dimensions of the foot of the shoe; to provide for stretching the leg and toe of a shoe simultaneously; and to provide an apparatus with movable parts to adapt the same for a variety of services.

MULTIPLE EFFECT FUSE FOR ARTILLERY PROJECTILES.—E. RIMAILHO, 98 Rue de la Victoire, Paris, France. The invention relates to a fuse for projectiles having in its construction a fuse carrier with oppositely arranged passages, one of which communicates with a passage leading to the rear charge of the projectile, a fuse body adjustably mounted on the carrier and a fire transmiting passage adapted to register with either of the passages, a member carrying a detonator and having a passage communicating with the other passage of the carrier, a carrier having notches, a fuse body provided with projections engaging the notches of the carrier and means for locking the projections in the notches.

SHUTTER-OPERATING ATTACHMENT FOR CAMERAS.—H. C. ATWOOD, Box 362, Ardmore, Okla. The object is to provide a device in the form of a time shutter which may be attached to a camera, and by means of which an exposure may be automatically made after a predetermined time. A further object is to provide a device which allows for instantaneous exposures or time exposures, and with which the exposure is timed accurately.

AIR PISTOL.—C. W. MATZ and C. H. HALE, Address C. W. Matz, 1916 Central St., Evanston, Ill. The invention provides an air pistol which has a cylinder with a chamber at one end of which there is a diaphragm movable outwardly when the air pressure in the chamber reaches a prede-



AIR PISTOL

termined point, the diaphragm is connected with a valve commanding communication between the chamber and the pistol barrel, when the pressure in the chamber is increased, the valve will be operated to permit the escape of air under pressure in the pistol barrel.

TRAP-DOOR.—T. DASTOLI, 507 Elizabeth St., Utica, N. Y. The invention is a simple and inexpensive metallic trap-door of great strength and durability with means for mounting a pair of door sections hingedly within an angle iron frame and for affording a firm support at the hinges so that the metal trap door will stand a relatively large amount of use and abuse without liability of injuring the hinged connections.

INK-GUARD FOR TYPISTS' FINGERS.—J. A. GAVIN, 16 Mathews Place, Flatbush, Brooklyn, N. Y. Among the objects of the invention are the protecting of typists' fingers from ink stains during the operation of changing the ink ribbons. The typist is relieved from the necessity of washing her hands after the operation is completed; another object is to provide a guard means of such simple and cheap nature as to be given with the purchase of each new ribbon and carried in the same container.

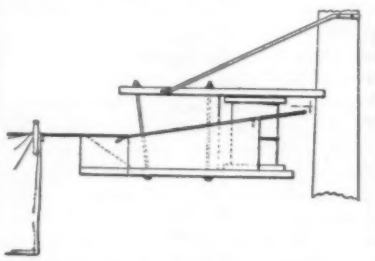
CALENDAR.—W. S. ORTH, Dunkirk, Ohio. The main object of the patent is to provide a device of the perpetual type wherein it is not necessary ever to reverse any of the cards at the end of a day, week, month, or year, in order to begin a new period, the cards always being turned in one direction.

WINDOW CLEANER.—G. DI GIOVANNI, 460 E. 171st St., New York, N. Y. An object in view in this invention is to provide a light but effective arrangement of pivotally mounted arms or bars and a cleaning member arranged at one end of one of the bars so that usually inaccessible parts may be reached, the improvement is so simplified that it is easily operated without the use of any appreciable energy either interiorly or exteriorly of the window when the operator stands in approximately the same position.

DISPLAY CARD.—M. R. WOOD, 218 William St., New York, N. Y. The invention relates to display cards adapted to be held in substantially vertical positions by means of self-contained braces and easels. The card has a cord connected at its ends with the edges of said card and an easel for maintaining the card, and for tautening the cord to flex the card to prevent distortion the easel is provided with an opening for the cord to maintain the latter in permanent connection.

WASTE-PAPER BASKET.—ADINE KUNATH 373 Fourth Ave., New York, N. Y. The invention relates to a knock-down receptacle, its object being to provide a waste paper basket formed of comparatively few parts, which can be readily shipped or stored while in flat condition, and which can be readily assembled to provide an ornamental and durable basket for the reception of waste paper or the like.

CLOTHES LINE SUPPORT.—W. MACK, 242 W. 149th St., New York, N. Y. The general object of the invention is to provide a device for supporting the outer extremity of the endless



A SIDE VIEW OF THE DEVICE MOUNTED ON A POLE

line, so that both lengths of the line can be used for hanging clothes, the line support is of simple construction, reliable and efficient in use, and so designed that the clothes on the line can readily pass in either direction around the distant pulley.

CLOTH UNROLLING DEVICE.—H. L. ROSENTHAL, 55 5th Ave., New York, N. Y. The invention has particular reference to means for supporting a bolt of cloth in such a manner that the cloth may be unrolled therefrom with the minimum amount of labor on the part of the operator, whereby the operator may unroll and lay the cloth upon a cutting table ply upon ply with the maximum facility preliminary to the cutting operation.

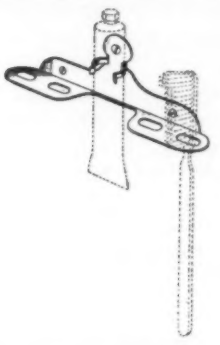
AUTOGRAPHIC ATTACHMENT FOR CAMERAS.—Z. E. HOUSE, Cass Lake, Minn. The inventor has for its object to provide an attachment for use in connection with cameras of any type, wherein the camera is provided with a slot in one side wall parallel with the plane of the film when in position to be exposed, a holder being provided having a sheet of transparent material adapted to receive written data and to cause the data to be impressed upon the film when it is exposed.

NAPKIN-HOLDER STAND.—J. MITCHELL, Pine Bluff, Ark. The invention has for an object the provision of an arrangement which may be easily and firmly clamped in position on a counter, so as not to be knocked over, though always in position for use in holding napkins and also for holding menu cards.

ADJUSTABLE SHADE-ROLLER.—R. B. CRUMP, 3206 Stockton St., So. Richmond, Va. The invention relates to shade rollers and curtain poles and has particular reference to a window shade roller adapting it not only for endwise adjustment, but also for quick attachment to or against the side walls of a window frame without the use of nails, screws or other fastenings. Among the objects is to provide securing means for the ends of the shade roller whereby it is adapted to be gripped against the vertical faces of the window frame.

CREMATORY.—A. C. FELTON, address Nye Odorless Crematory Co., Macon, Ga. The invention is an improvement in furnace for use in incinerating various refuse matter, it includes an incinerating chamber having a grate section an arch over the chamber and a charging floor above the arch forming an air space there between, the arch having a plurality of air flues extending along its underside communicating at one end with the air space above the arch, and incinerating chamber having a vertical flue opening at its lower end below the grate section and with which the opposite ends of the said air flues communicate.

BRUSH HOLDER.—G. T. HASTINGS, 530 Washington St., New York, N. Y. The object of the invention is to provide a tooth-brush holder, which is simple and inexpensive which will ac-



PERSPECTIVE VIEW OF THE HOLDER

commodate one or more brushes and support a container for a tooth-cleaning medium. A further object is to provide a holder formed of a single piece of metal in which the container supporting means are of a resilient nature.

DETACHABLE HEEL.—G. E. GILBERT, 14 Melbourne Ave., Toronto, Ontario, Can. The invention relates to rubber heels attachable to leather heels in a manner to be detachable or interchangeable to insure such an interchangement between the rubber and leather heel elements so as to make it impossible for the rubber heel to become accidentally detached or displaced while at the same time the rubber heel may be secured in position or removed with facility.

CONDENSER.—A. K. WHITELAW, 426 N. Bloom Ave., Louisville, Ky. This condenser is particularly adapted for use in connection with crude petroleum; it comprises a pair of concentric cylinders forming an annula chamber, means for supplying fluid to the annula chamber, an overflow from the chamber into the inner cylinder the inner cylinder having a vapor inlet, and baffle plates interposed between the overflow and the vapor inlet, the inner cylinder having a vapor outlet.

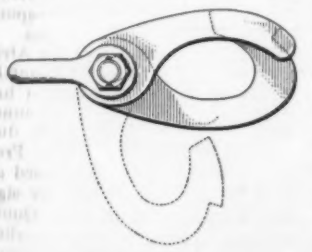
SHIP PROTECTION AGAINST SUBMARINE EXPLOSIONS.—G. E. ELIA, Turin, Italy. The general object of the invention is to provide a protective shell around the hull of a ship from stem to stern and along both sides in order to prevent destruction of the hull proper by the explosion of a torpedo or mine, the space between the shell and the hull containing a vacuum so that when the shell is punctured the high pressure and temperatures produced by the explosion can be accommodated by the vacuum space, the force against the hull being considerably diminished.

SACK HANDLE.—E. N. MALVERN and W. W. JONES, Maryville, Mo. The object of the invention is to provide a sack handle by means of which cement and other sacks may be conveniently handled, two handles are provided one for each end of the sack and flexible means disposed around the ends of the sack for pressing the ends against the handles.

Hardware and Tools

PORTABLE BURGLAR-ALARM.—L. LEMBERG, 647 Sheffield Ave., Brooklyn, N. Y. The invention has for its object the provision of a portable device which can be readily set up in any place where protection against burglary is desired, the construction is so designed that when tripped by the opening of a door or window, will cause the giving of an alarm which will continue to sound until the warning is heeded and the device reset.

HOOK.—E. ERICKSEN, address Anderson and Setters 486 Commercial St., Room 384, Astoria, Oregon. The invention has for its object to provid a device arranged to permit the hook to be easily and quickly connected, and to positively



A SIDE VIEW OF THE HOOK

prevent accidental detachment. The hook comprises a body and a bill and a clip or clevis is connected with he body by means of a bolt and nut, a spring actuated locking bar in connection with the keeper and engaging the end of the bill of the hook, for preventing inward movement.

(*Concluded on page 280*)

LEGAL NOTICES

OVER 70 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

INVENTORS are invited to communicate with **Munn & Co., 233 Broadway, New York,** or **625 F Street, Washington, D.C.,** in regard to securing valid patent protection for their **Inventions. Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over **seventy** years ago.

All patents secured through us are described without cost to patentee in the **Scientific American.**

MUNN & CO.
233 Broadway Woolworth Building **New York**
Branch Office: 625 F Street, Washington, D. C.

Annual Subscription Rates for the Scientific American Publications

Subscription one year..... $4.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama.
Subscriptions for Foreign Countries, one year, postage prepaid..... $5.50
Subscriptions for Canada postage prepaid... 4.75

The Scientific American Publications

Scientific American (established 1845)..... $4.00
Scientific American Supplement (established 1876)..... 5.00
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

HELP WANTED

DRAUGHTSMAN with experience in designing light weight machines of precision—one who has had experience with motion picture cameras preferred. C. R., Room 419, 1777 Broadway, New York City.

J. M. COLMENARES

Lima, Peru, Espaderos Street, No. 569, P. O. Box 277. Accep s important representations and attends to commercial propaganda.

WANTED

MANUFACTURER of nationally known product wants additional articles for unlimited market. Will manufacture and sell. Write The Cramer-Krasselt Co., 354 Milwaukee St., Milwaukee, Wis.

POSITIONS OPEN

The Western Electric Company, Incorporated, has opportunities for physicists, chemists, engineers, designers, and draftsmen, for work of research, development, and design related to problems of telephonic, telegraphic and radio communication which are matters of public importance. Both temporary and permanent positions are open. Apply by letter, not in person unless so specifically requested, to F. B. Jewett, Chief Engineer, 463 West St., New York, N. Y.

BUSINESS OPPORTUNITY

A manufacturer of snap-fasteners, controlling machinery and patents for the manufacture of the same, can make additional machines to be used in foreign countries.
Full patent rights for both the machine and the article can be secured for the respective countries.
This is an excellent opportunity for a foreign firm that is desirous of manufacturing this commodity domestically.
No machines or rights will be sold for use in the United States. SNAP FASTENER. Box 773, N. Y.

HANDY MAN'S WORKSHOP AND LABORATORY

Compiled and edited by A. Russell Bond. 6x8¼ inches. Cloth. 467 pages. 370 illustrations, $2.00.

A compilation of hundreds of valuable suggestions and ingenious ideas for the mechanic and those mechanically inclined. The suggestions are practical and the solutions to which they refer are of frequent occurrence. It may be regarded as the best collection of ideas of resourceful men published.

MUNN & CO., Inc.
Woolworth Building New York

ONE young man says, after a course at Bradley, that "it was the best investment that he ever made when he spent two cents for stamp to send for catalog of the course in watchwork, jewelrywork and engraving.

He is now in business for himself as leading jeweler of his town, has a stock of $15,000 all paid for, and all this due to the above investment.

What others have done you can do. Address a letter to BRADLEY HOROLOGICAL and get our latest book telling you all about it.

BRADLEY HOROLOGICAL, PEORIA, ILL.

Experimental Science

Elementary, Practical and Experimental Physics. By George M. Hopkins. 2 volumes. 6¼x9¼ inches. Cloth. 1,105 pages. 918 illustrations. $5.00.

This work treats on the various topics of physics in a popular and practical way and contains a fund of trustworthy scientific information, presented in a clear and simple style. In the latest edition, the scope of the work has been broadened, presenting the more recent developments in modern science, which will assist the reader in comprehending the great scientific questions of the day.

MUNN & CO., Inc., *Publishers*
Woolworth Bldg. New York City

Mobilizing the Farm Machinery

(Concluded from page 274)

chinery, the food chopped and stored in silos, the tools kept sharpened, the water pumped, the products hauled to market—all by machinery. Even the farmer's wife has had her labors lightened by the gasoline engine, or the tractor motor hitched to her washing machine or the churn. If she has to make the boy's clothes, her sewing machine can be belted to the same source of power.

The evolution of the plow, man's first primitive means of cultivation, has been remarkable. From the pointed stick held in the ground while being pulled by the meek ox, the next step was to a band of sharpened iron fastened to the wood. This was considered a great advance, and by later steps man devised and used a wholly iron curved plow that greatly simplified his work. But in the olden days every cross-roads blacksmith shop was a plow factory, and there were as many styles as there were makers of them. Today, the modern disk plow is a series of sharpened disks made from the finest steel, that turn up the soil with such regularity and so thoroughly that the work of harrowing and leveling is reduced to a minimum. With a powerful tractor to pull a battery of these plows, it is possible to prepare more ground in a day than a farmer, with a team, could plow in a month.

Not the least of the advantages derived from the use of modern farm machinery is the saving of labor. As a boy, I remember going, in the fall of the year, to a neighboring farm, of rather small proportions. It seemed to me that I had never before seen so many men at work as were engaged in the harvesting and threshing of the wheat from that farm. While a threshing machine was used, it was the old-fashioned kind, requiring lots of help, and the shocks of wheat were all handled by man-power. The women of the farm were up before daylight to cook enough food to feed the small army of laborers. On that same farm today, with the aid of up-to-date machinery, the entire crop could be handled with the assistance of only two or three outside men. This is going to be a big item in the harvesting of the crops this year, and the government officials are strongly urging all farmers who have labor-saving machines to use them not only on their own lands, but on the lands of their less fortunate neighbors.

Many enterprising young men are making good livings, and developing a profitable business by doing contract work with a tractor outfit in rural districts. There are many farmers who feel that they cannot afford to purchase a tractor and other expensive machinery for their exclusive use, and yet who realize the value of these machines in the various stages of crop development. These farmers are only too glad to contract for their plowing at so much an acre, and the tractor owner can make a nice profit and still do the work faster, cheaper and better than the farmer could by using his own teams and hiring outside laborers. When the plowing is finished the tractor owner will look around for another job, and perhaps haul wood to market, or pull stumps from a timbered region, or any one of a dozen items waiting to be done.

Probably no one factor has been more important in changing the life of the farmer than the development of the automobile. Before its advent, transportation facilities were restricted to the farm wagon, or the country buggy. Roads were exceedingly poor, and a trip to town was an all-day event. At best, only a small load of produce could be hauled to town, and during rainy weather the farmer often found difficulty in getting through the mud with the lightest vehicle. These conditions were reflected in the mode of living on the farm. There were fewer comforts, fewer books or magazines, fewer of the things that developed the mind and made life enjoyable. With the coming of the automobile, however, this changed. The farmer found he could get into town more quickly and carry a bigger load, and his visits to the city became more frequent, and more of the influence of the city crept into the country home. The city merchants and automobile owners joined with the farmers in constructing good roads, and the isolation of the farm was done away with. If a certain need was felt that could only be supplied in the city, instead of waiting for the weekly trip, the farmer, or his son or his daughter, jumped into the car and in an hour or so was back with the desired article. By the use of trailers, the farmer could take a load of produce to market, using his automobile as the pulling power. In a great many communities the modern tractor is being used for transporting all supplies to market, as one of these machines has power enough to pull from three to six heavily loaded wagons at one time. If the farm is large enough to warrant the equipment, a truck is added, which is used to carry the supplies to and from the city, or in hauling jobs around the farm.

The advent of farm machinery has brought to the farmer, too, more time to plan for the development of his place, and more leisure to investigate the scientific methods for increasing crop yields or the betterment of particular species of plants. By the use of nitrogen-fixing bacteria, it is possible to double the yield of grain, and at the same time secure a better quality. By utilizing the barnyard manure, or by introducing commercial fertilizers, the fertility of the soil is improved. Again, the buildings for housing the live stock, or the chickens, can be improved during the time saved, and the living conditions of the farm animals improved. All of which adds to the bank account and the satisfaction of Mr. Farmer.

Petroleum in Britain

MANY of our readers will learn with surprise that the British government has initiated measures looking to the exploitation of oil fields in the United Kingdom. It appears as a result of expert investigation that petroleum deposits long suspected by geologists to exist in well defined strata of certain areas are really worth developing, in view of the necessity for adding to Britain's fuel resources and thus lessening the huge importation of liquid fuel.

Much English money has in recent years been invested in the exploitation of foreign oil fields, whilst evidences of petroleum deposits at home have been overlooked or ignored, No country has been so bored as England, and yet no country has been less tested at the ordinary oil depths; for it is at a depth below the objective of the coal miner that oil must be sought, in Great Britain at least. The fact is, of course, that the presence of petroleum in bulk and at commercially accessible levels has not struck into the comprehension of the British capitalists.

Yet the bare fact that oil exists in England is far from a new one. Petroleum has "occurred" at many points in Yorkshire, Derbyshire and Lancashire, as far west even as Leigh and Wigan, within 10 miles of Liverpool. At Southgate Colliery, Derbyshire, an intermittent flow of petroleum and water in about equal volumes amounted to seventy to a hundred gallons daily, the rock from which it issued lying at a depth no greater than 320 yards. At Alfreton in the same county a 300-gallon flow lasted long enough to make possible the manufacture of paraffin. More recently a boring near Newark, in Nottinghamshire, led to the discovery at a depth of 2,439 feet of oil-sands 13 feet thick, believed by some observers to be but the upper layers of a productive series of indefinite thickness.

This boring had passed through coal measures into millstone grit, containing highly saline water, then into fireclay, some shale and finally the petroliferous sandstone. Experts have been led to the conclusion that these northeastern counties contain a large oil field, extending possibly along the Trent valley to the Derbyshire coal fields. The oil escapes heretofore noted can hardly be erratic in every case; they must be the outward and visible signs of large deposits. Already there is a scheme on hand for the Government to grant oil licenses on payment of a royalty of nine pence per ton, and it seems likely that whatever wealth of this nature lies hidden beneath British soil will be duly uncovered.

Oh-Thomas

"Take these shoes over to the repair man. Tell him to put on a pair of

CAT'S PAW
CUSHION
RUBBER HEELS

"Don't forget that name. It's the kind with the Foster Friction Plug that prevents slipping. No, no other heel will do.

"You see there are no holes to track mud and dirt into the house. Fine heels for you, too, Thomas, less noise around the office, and you'd feel safer on the street.

"The repair man will put them on while you wait."

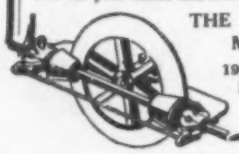
50c. attached, black, white or tan. For men, women and children, all dealers

FOSTER RUBBER COMPANY
105 Federal Street - - Boston, Mass.
Originators and patentees of the Foster Friction Plug which Prevents Slipping

Rockwood
Friction Transmission

means transmission efficiency. It eliminates costly repairs and delays that toothed gears cause by tripping and burring. They have all the advantages of toothed gears with none of the disadvantages. Some place in your plant you can save time and money by installing friction transmission—investigate today.

Send for 92 page free book "Friction Transmission". Contains valuable data and formulae for designers and engineers. Sent free for your name and firm connection.



THE ROCKWOOD MFG. CO.
1904 English Ave.,
Indianapolis, Ind
U. S. A.

SWALLOWS RIFLE NOISE

"Wonderful," you say. "Where does that ear-splitting report go?" Just equip your rifle and enjoy every minute while on your hunting trip, at the training quarters, or on your own premises. A

Maxim Silencer

MAKES YOUR AIM SURER
—prevents nervous tension; allows girls and boys to practice as marksmen without disturbance.

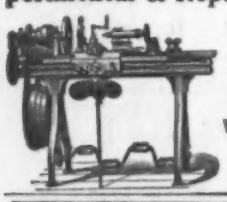
Our free booklet has a fund of good stories worth your reading. Write for it now.

This Book Free

The Maxim Silencer Co.
94 Homestead Avenue
Hartford, Conn.

VENUS
10¢ PENCIL
17 Degrees 17 Perfect Degrees
AMERICAN LEAD PENCIL CO. NY

For Gunsmiths, Tool Makers, Experimental & Repair Work, etc.



From 9-in. to 18-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

W. F. & J. Barnes Co.
Established 1872.
1999 Ruby Street
Rockford, Ill.

GOODELL-PRATT
1500 GOOD TOOLS

SOUTH BEND LATHES
Established in 1906 Making Lathes over 20 years

How to Run a Lathe
A 64 page book
For 10c Postpaid
Coin or Stamps

For the Machine and Repair Shop
LOW IN PRICE
10 in. to 24 in. swing
Straight or Gap Beds.
Send for free catalog giving prices on entire line.
South Bend Lathe Works
421 Madison St.,
South Bend, Ind.

THE BRIDGEPORT CHAIN CO.
Specialists in Small Wire Shapes & Flat Stampings
Bridgeport, Conn.

THE SCHWERDTLE STAMP CO.
STEEL STAMPS LETTERS & FIGURES
BRIDGEPORT CONN.

MASON'S NEW PAT. WHIP HOIST
for Outrigger hoists. Faster than Elevators, and hoist direct from teams. Saves handling at less expense.
Manufactured by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

Experimental and Model Work
Electrical Instruments and Fine Machinery.
Inventions Developed.
Special Tools, Dies, Gear Cutting, Etc.
HENRY ZUHR, 200 to 204 William St., New York City

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES.
LIGHT AUTOMOBILE STAMPINGS
F. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

WELL DRILLING PAYS WELL
Own a machine of your own. Cash or easy terms. Many styles and sizes for all purposes
Write for Circular.
WILLIAMS BROS., 434 W. State St., Ithaca, N.Y.

RECENTLY PATENTED INVENTIONS

(Concluded from page 278)

TIRE TOOL.—C. W. DOYLE and C. F. ROTHWELL, Columbus, Mont. The invention has for its object to provide mechanism, for use with quick demountable tires, for collapsing the rim to permit the easy removal of the tire. The tool comprises a clamping member consisting of a

PERSPECTION VIEW SHOWING THE MANNER OF USING THE TOOL

gripping jaw of substantially cylindrical form adapted to extend transversely of a rim, and spring actuating jaws in connection with the gripping jaw each of the clamping jaws consisting of a hook mounted to slide in the gripping jaw and a spring normally drawing the clamping jaws together.

SASH LOCK.—H. L. KILLOGG, Address W. A. RUNGE, care of Sumter Mfg. Co., Livingston, Ala. The invention relates to means for locking window sashes either for adjustment as to the degree of opening, or for the prevention of exterior manipulation, as by thieves seeking unlawful entry into a house, the object is to supply a lock which is simple in construction, installation and operation, one that having few parts is not likely to get out of order, and which is very inexpensive.

CONTAINER.—J. MARSH, care of Enterprise Paint Mfg. Co., Peoria and Van Buren Sts., Chicago, Ill. The invention relates to containers particularly adapted to paint, the main object being to provide in combination with a conventional can, a receptacle for a portion of the contents of the can, after the latter has been opened forming a component part of the can and portable therewith.

Heating and Lighting

GASOLINE LAMP.—J. OWENS, 1,224-29th St., West, Washington, D. C. The prime object of the invention is to provide a gasoline lamp of the utmost simplicity, the construction of which enables the production of an inexpensive lamp, both as to first cost and upkeep, the several parts being such as to not only permit of ready insulation, in the first instance but detachment, repair or substitution without the necessity of skilled labor or the use of special tools and implements for this purpose.

Machines and Mechanical Devices

ALARM FOR HOISTING ENGINES.—W. J. LILLY, 810 W. Galena St., Butte, Mont. The invention relates to alarm mechanism for hoisting engines, and controlling mechanism for the same the parts are so arranged that the engineer has an opportunity after receiving a warning signal from the bell, to check the speed of the engine, or shut off the power.

MANUFACTURE OF HOSIERY AND OTHER KNIT ARTICLES FROM RAW SILK.—M. WEIL, care of Gotham Silk Hosiery Co., 430 E. 53d St., New York, N. Y. The object of this invention is to provide a device for use in the manufacture of knit hosiery and other knit article from raw silk whereby the spinning or throwing of the silk is entirely dispensed with and the hosiery produced is of the desired density without an increase in the number of raw ends used for each knitting member or strand.

GRINDING AND TUMBLING MILL.—F. H. ENSIGN, care of Ensign Foundry Co., Toledo, O. The object of the invention is to provide a grinding and tumbling mill for use in reducing or grinding upcores, cupola cinders, waste end cores, old cores, waste fire brick linings, or for cleaning castings and freeing them of core sand. Another object is to provide a continuous and ready escape for the reduced material, without requiring stopping of the revolving barrel of the mill.

ATTACHMENT FOR HIGH SPEED WINDERS.—M. WEIL, care of the Gotham Silk Hosiery Co., 430 E. 53d St., New York, N. Y. The invention relates to high speed winders arranged to permit of knitting hosiery. In order to accomplish the result use is made of a vertically disposed spindle adapted to carry a spool filled with a thread formed of doubled, untwisted raw silk ends, a flexible flier arm mounted to swing on the spindle, an electric band held on the free end of the flier arm provided with a thread guide for the passage of the thread unwinding from the spool.

VENDING MACHINE.—L. J. LINKIEWICZ, Box 40, 203 Montrose Ave., Brooklyn, N. Y. The invention has for an object the provision of a construction for vending small articles successively from a container or hopper in which only one can be discharged on each operation of the machine. A still furthe object is to provide in a vending machine an arrangement of coin actuated mechanism and automatic resetting means.

FUEL FEEDING SYSTEM.—F. CALDWELL 7510 Cornelia Ave., Carthage, Cincinnati, O. This invention relates to that class of hydrocarbon combustion device in which the air and oil are used under pressure to produce the burning or heating medium. The apparatus comprises the combination of an oil receptacle having means for churning the oil to cause the same to foam, a pipe for feeding the air under pressure, and independent air feeding pipes in communication with the outlet from the receptacle at spaced points.

DREDGER.—S. D. WAYSMAN, Afton, Glen Co., Calif. The invention relates particularly to such operations as the reclamation of previous metals, from the earth, especially in sand, gravel, and the like in the beds of s re.ms where they have been deposited by the action of water, and the main object is a dredger having a wide range of operation, which may readily be moved, which has means for positively anchoring in desired positions, which concentrates the materials dredged, and which amalgamates the placer minerals with a suitable medium and thus separates them from the concentrates.

CLUTCH.—E. WILLIAMS, Edgbaston, Birmingham, England. The invention has for its particular object the construction of a friction clutch especially for use in machine tools such as lathes, milling machines and the like.

The invention comprises the combination with an inner conical sliding member which is arranged to coöperate with an outer complementary member, of a pair of radially disposed operating levers a rotary fulcrum on which the outer ends of the levers are pivoted, the inner clutch member being actuated in ine direction by a central rod through the medium of the levers and in the other direction by a spring.

Medical Devices

CASE FOR HYPODERMIC INSTRUMENTS.—B. W. SCOTT, Nacozari, Mexico. An object of the invention is to provide a convenient case for carrying hypodermic instruments, in which the instruments are so supported that the same are easily accessible, and can be placed above the edge of the case so as to facilitate the extraction of any of them.

HERNIA TRUSS.—J. A. STEINERT, 289 E. 157th St., Bronx, N. Y. An object of the invention is to provide a hernia belt carrying in standard or fixed position a rigid bracket, the axis of which is substantially vertical or parallel to the median line of the abdomen and adapted to carry on its lower end a novel form of pad adjustable around an axis, so as to adapt its position to the individual, to relieve in the most comfortable and effective manner the protruding viscera.

Musical Devices

AUTOMATIC STOP FOR TALKING MACHINES.—LE ROY ARMITAGE, 128 Park Ave., East Orange, N. J. The invention has for an object to provide in electrically driven talking machines mechanism whereby the power is shut off as soon as the playing of the record has been completed. A further object is to provide a pair of contact arms one of which is operated by the tone arm of the machine, the other by the driving mechanism whereby when the tone arm stops its swinging movement the contact carried thereby will become stationary so that the other contact driven by the motor may become engaged therewith.

TALKING MACHINE.—W. S SAMUEL, 32 Worship St., London, England. The invention relates to improvements in gramophones of the type known as the "deflector" or "reflex" types in which the usual large horn or trumpet is replaced by a deflector opposite to which the conduit or small trumpet leading from the tone arm is situated. The object is to provide a casing with the device to prevent dust or other foreign matter entering the tone arms and fittings.

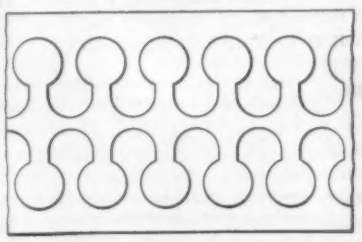
Prime Movers and Their Accessories

LOCOMOTIVE STACK AND DRAFT DEVICE.—W. ELMER, Supt. Motive Power, Northern Division, Penn. R. R., Buffalo, N. Y. The object of the invention is to provide a draft device arranged to discharge large particles of coke and cinders through the stack thus preventing the accumulation of coke and cinders in the smoke box and thereby providing a self-cleaning smoke box. In order to produce the desired result use is made of a stack provided with a series of nested conduits and an exhaust nozzle having a series of independent tips centrally disposed below the entrance of the conduits.

PISTON CONSTRUCTION.—A J. WANNER, 23 R. D., Box 78, E. Akron, Ohio. The principal object of the invention is to provide and simplify the construction of pistons, particularly of the type used in internal combustion engines, by making the wrist pin bearings separate from the piston, means being provided for securing the bearings in place in the piston when assembling the piston and connecting rod

Pertaining to Vehicles

DESIGN FOR A TIRE.—R. F. AMERICA, 1218 So. 16th St., Philadelphia, Pa. The invention relates to an ornamental design for a tire



DESIGN FOR A TIRE

such as are used on automobiles and other vehicles. The illustration shows the face view of a section of a tire embodying the new design.

TRAILER.—L. WATKINS, 1025 Myrtle Ave., El Paso, Texas. The object of the invention is to provide means which will allow an easy turning movement where a number of trailers are connected while admitting of strain between the various trailers whereby they are propelled properly around a curve. A further object is to provide a construction by which the wheels may be connected in such a manner that they will follow in the same track either in a straight line or when moving around a bend.

OVEN.—E. C GREINER, Globe, Ariz. The invention has for its object to provide a device especially adapted for military use, wherein the oven is mounted on a motor, and wherein the exhaust of the motor is utilized for assisting the heating of the oven, and the power plant of the motor utilized to drive the carrier of the oven.

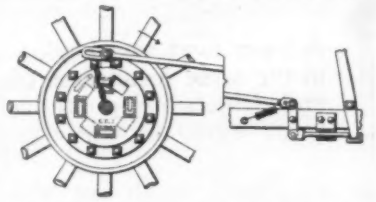
TIRE CASING.—W. C. RIEBE, 1186 Washington Ave., Bronx, N. Y. The invention relates to containers for extra tires of automobile wheels, the object is to provide a casing arranged to safely house and protect a tire such as are now generally used, at the back of the automobile, another object being to permit of conveniently and quickly placing the tire in position in the casing or removing it therefrom.

AUTOMOBILE JACK.—W. A. STEWART, 37 Hawthorne Ave., Yonkers, N. Y. The invention provides an attachment which may be rapidly secured in operative position to the hub cap of the wheel of an automobile, and used in connection with the standard lever or other type jack, for lifting the wheel from a mud hole when it becomes mired, the device is strong, simple, and inexpensive.

HOSE CLAMP.—T. A. BOON, Ashville, Ohio. —The objects of the invention are to provide a clamp especially designed for securing a hose section about the adjacent ends of the pipe segments connecting an automobile engine with its radiator, the clamp is in the nature of a springband resiliently retaining the hose against the pipe segment in such a manner as to expand and contract with the metallic pipe so that a water tight joint is continuously maintained

GEARLESS DIFFERENTIAL.—A. F. FORD, Pendleton, Ore. (Gen'l Delivery), Walla Walla, Wash. The invention relates to differential mechanisms for the rear shafts of automobiles. An object is to provide a differential clutch which includes axle disks mounted on the opposed ends of the rear axle, means being disposed between the axle disks for locking the disks endwise with the driving element of the transmission.

SAFETY REVERSE-MOVEMENT LOCK FOR AUTOMOBILES.—C. P. CIRAC, address G. J. Kenny, Atty., Rooms 5 and 6, Churchill County Bank Bldg., Stillwater, Nev. One of the principal objects of the invention is to provide a safety device for use in connection with automobiles, for automatically operating to pre-



VIEW SHOWING THE ARRANGEMENT WHEREBY THE DEVICE IS CONTROLLED BY THE GEAR SHIFT LEVER OF THE AUTOMOBILE

vent accidental reverse movement of the machine, the apparatus being movable into position to allow reverse movement, through the movement of the gear shift lever into "reverse" position. The device could be used on all sorts of machines such as hoisting engines, traction engines, and street cars, it is simple and durable.

TIGHTENING AND LOCKING DEVICE FOR ANTISKID CHAINS.—R. BRIGGS, 1307 Stout St., Aptm 9, Denver, Colo. The principal object of the invention is to provide a simple and durable tightening and locking means fo anti-skid chains such as are applied to pneumatic automobile wheel tires, having a lever arrangement for drawing the ends of the chains together and for locking them in drawn and taut position against accidental release

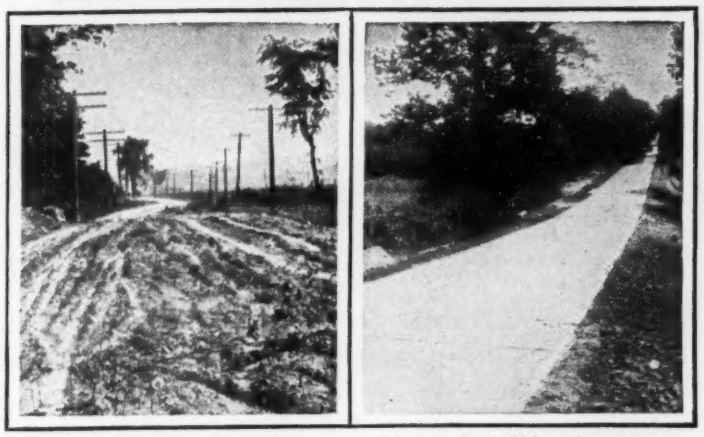
GRIP FOR AUTOMOBILE TIRES.—P. SMITH, Foresthill, Calif. The prime object of the invention is to provide an attachment that may be applied to the shoes of automobile tires to present effective gripping members and of a character to accommodate itself to the flexure of the tire. A specific object is to provide an attachment composed of sections made up of parts that may be readily assembled, durable and not liable to become disarranged.

TRANSPARENT LICENSE TAG AND HOLDER.—H. W. PAYNTER, 4319 Otter St., Philadelphia, Pa. The invention relates to transparent indicators and has for an object the production of a device which will indicate distinctly in daylight or at night the license number of a vehicle more particularly an automobile, means are provided for adapting the holder to display tags of different sizes, it can be readily cleaned and repaired. The device comprises a sign plate and holder, a tail light, bull's eye and a tubular electric wire conduit for illuminating.

SAFETY FENDER.—A. LEIBNER, 921 8th Ave., New York, N. Y. The invention relates to fenders for vehicles, and particularly for automobiles the object is to provide a construction which will normally act as a bumper, but which is foldable and may be telescopically fitted into a holder beneath the front part of the vehicle in such a way as to be readily released for spreading a net or receiving sheet to act as a fender in front of the vehicle.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patented title of the invention, and date of this paper.

Which Road Is Yours?



An Earth Road which requires at least a 218-pound pull to each ton

A Concrete Road which requires an average pull of only 27.6 pounds to each ton

IT takes a pull of 218 pounds to get a 1-ton load over the road on the left, when you can get over it at all. In wet weather you can't get over it at all; even in dry weather it is rough and dusty. On the right, where the road has been paved with concrete, it takes a pull of only 27.6 pounds. It never takes more than that in the worst kind of weather—winter or summer—because it is hard and clean.

Which Road Do You Want?

Everybody knows that it is easier to haul on a concrete road than on any less rigid surface. But few realize how great is the difference. This has been recently determined by tests made with a dynamometer by Prof. J. B. Davidson, Agricultural Engineer, University of California, made for the Good Roads Bureau of the California State Automobile Association.

A 3-ton load was hauled over various types of roads in the same locality on the same day, the same horses and drivers being used. The dynamometer recorded tractive pull in pounds per ton of load as follows:

	Pounds
Over a level, unsurfaced concrete road	27.6
Concrete base, ⅜-inch skin top asphaltic oil and screenings	49.2
Waterbound macadam, level, good condition	64.3
Concrete base, 1½-inch Topeka top, level, good condition	68.5
Gravel road, good condition, level	78.2
Earth road, fine dust, level	92
Earth road, stiff mud on top, firm underneath, level	218
Loose gravel, not packed down, new road, level	263

Remarkable showing for concrete—less than half the tractive force required over a good stretch of water-bound macadam, less than one-third that required on dirt or packed gravel, about one-tenth the pull required on loose gravel.

You pull ON a concrete road, where you pull AGAINST an unimproved, rough or boggy surface. Where one wastes power, the other saves. Power costs money, whether you feed a team or buy gasoline. Your saving in power will pay your share of the cost of a concrete road.

There are 30,000,000 horse drawn vehicles in this country, most of them on farms, and 3,500,000 motor cars and trucks. The waste of horse power, of time, and motor fuel involved, not in poor roads, but in all roads less desirable for traction than concrete, is enormous. Besides this waste, the United States Office of Public Roads estimates that $200,000,000 per year is paid out indirectly for bad roads in extra cost of food. What is paid out for maintenance of roads that won't stay built is incalculable. It runs into hundreds of millions more. The excess consumption of gasoline is another huge item which motor car owners have to pay.

Can any community afford to neglect its highways in view of these facts, or to build them of any material less enduring or less desirable for traction than CONCRETE? Its construction cost is lowest in the end and its upkeep cost is lowest from the start.

Concrete Roads
Their Advantages:
No Mud—No Dust
No Ruts—No Holes
No Slipping
No Skidding
Easy Washing
Smooth Riding
Long Life—Safety
Always Ready for Use
Low Maintenance
Moderate Cost

Be sure you know what a concrete road is. Concrete is made of portland cement, sand and pebbles or crushed stone, and water. It is hard and durable. Concrete is the material used in dams, factories, bridges, and big engineering works like the Panama Canal, requiring great solidity and strength.

Let us give you some interesting figures. Write for free copies of Bulletins Nos. 107 and 136.

PORTLAND CEMENT ASSOCIATION

Offices at

ATLANTA CHICAGO DALLAS DENVER INDIANAPOLIS KANSAS CITY MILWAUKEE NEW YORK PITTSBURGH SALT LAKE CITY SAN FRANCISCO SEATTLE WASHINGTON, D. C.

CONCRETE FOR PERMANENCE

"He had a dream and it shot him!"

FRIGHTENED—ragged—dirty—the boy stood. It was midnight and the doctor, waked up from sleep, demanded—"But how did they shoot him?" The boy trembled—stuttered. "He had a dream and it shot him."

Don't you remember it—how that boy was Huck Finn—and how Tom Sawyer was shot—and Huck's preposterous, terrified explanation?

How it rolls back the years! How it carries you back to the day, when as a youngster you read and reread Huckleberry Finn until you nearly died laughing.

Have you read Huck Finn this year and realized its bigness—its philosophy—its sadness—all those things, which now to you, become so mixed with the laughter of youth? For Mark Twain was the most serious of all our writers—he was a great fighter for freedom, for liberty, for ideals.

MARK TWAIN

25 VOLUMES

"He traveled always such a broad and brilliant highway with plumes flying and crowds following after"—and his death left nations weeping. But in a larger sense he is not dead. He lives forever in work more truly American than that of any other man.

RUDYARD KIPLING, writing to the most important officials in India, said: "I have seen Mark Twain this golden morning, have shaken his hand, and smoked a cigar—no, two cigars with him, and talked with him for more than two hours! Understand clearly that I do not despise you; indeed I don't. I am only very sorry for you, from the Viceroy downward."

Last Chance for the Low Price
Send Coupon at once!

BOY STORIES
Get back the glamour of youth. Read once more of Tom Sawyer, the best-loved boy in the world; of Huck, that precious little rascal; of all the small folks and grown folks that made Mark Twain so dear to the hearts of all.

HISTORY
Read "Joan of Arc" If you would know Mark Twain in all his greatness—the most amazing story in the world—accurate as history, spiritual in idea, beautiful in execution.

ROMANCE
Everything he wrote was touched with the golden freshness of youth and romance whether in such books as "The Prince and The Pauper"—"A Connecticut Yankee" or "Roughing It."

SHORT STORIES
They are so many and so good.

ESSAYS
He could not see injustice without fighting it. The flame of his anger seared and burst forth in essays that will live forever.

TRAVEL
You have not seen the world until you see it through Mark Twain's wise and humorous eyes.

Perhaps you think you have read a good deal of Mark Twain. Are you sure? Have you read all the novels? All the short stories? All the brilliant fighting essays—all the history?

Mark Twain has been translated into more foreign languages than any other American writer.

Why the Price Must be Raised

To Mark Twain two things were precious above all others—one was a love for his wife—the other was a love of the people. At every side he was surrounded by tributes of honor, by joyous affection. In every corner of the world he was known and loved. And because of this it was his desire that his books be so made and sold at such a low price that every family could own a set.

So this set of Mark Twain has been sold at a much lower price than would ordinarily be the case for a set of books of this character. But Mark Twain could not foresee that the price of ink, paper, binding—that everything that goes into the making of a set of books—was to go to heights undreamed of even two years ago. It is impossible to continue the sale of this set of books at that low price. For a few weeks longer—until the present edition is taken up—this low price will be in force, but on the next edition the price must be higher.

If you send the coupon at once you can have your set at the low price—but send the coupon at once.

HARPER & BROTHERS
1817-1917
NEW YORK

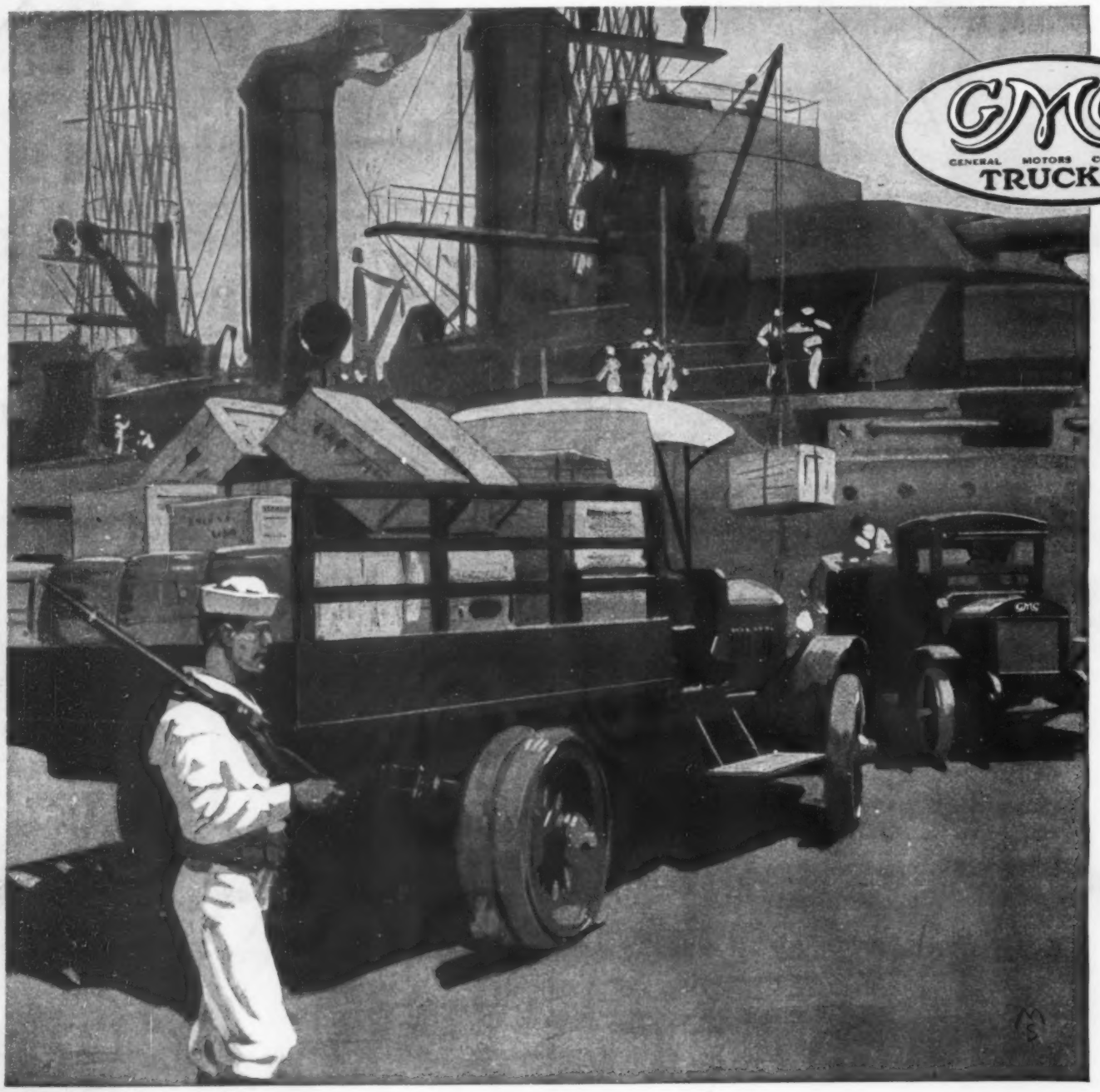
HARPER & BROTHERS
Franklin Sq., N. Y.

Send me, all charges prepaid, a set of Mark Twain's works in 25 volumes, illustrated, bound in handsome green cloth, stamped in gold, with trimmed edges. If not satisfactory, I will return them at your expense. Otherwise I will send you $2.00 within 10 days and $2.00 a month for 12 months, thus getting the benefit of your half-price sale.
S. A. 10-16-17

Name.....

Address.....

For our beautiful red half-leather edition, change above terms to $2.50 after examination and $3 a mo. for 20 mos.



GMC trucks are built in all practical sizes, ¾-ton to 5 ton capacity — six sizes in all. Each size better suited than all the rest for a certain class of work.

GMC Trucks Back Up the Big Guns—

Battleships and armies, shells and munitions—these are vital needs in our nation's war. Without them victory is impossible.

But important as they are, this war's winning depends in greater measure on our industries. Never must pressure be put on production as now; never have our mills, factories and farms been forced to such supreme efforts.

And aiding in this mighty work, backing our guns at the front, pushing our production at the rear, GMC Trucks are stepping into the breach.

Their steady, sure methods, their never-faltering performance, their strength, ruggedness and power enable them to surmount trying transportation obstacles

They are returning maximum profits when their motor is rarely quiet; when loading and unloading is reduced to minutes and operation time given over to performance on the road.

They do day and night work if necessary, make long trips cross-country over rough roads and difficult grades, haul huge loads at increased speed. They aid the railroads in transportation, help American industry bear up under war's burden.

Just as GMC Trucks are helping thousands of business men in every part of the country—in every line of work, so they can help you in your business. Write us at TRUCK HEADQUARTERS for information on GMC Trucks in your line.

GENERAL MOTORS TRUCK COMPANY

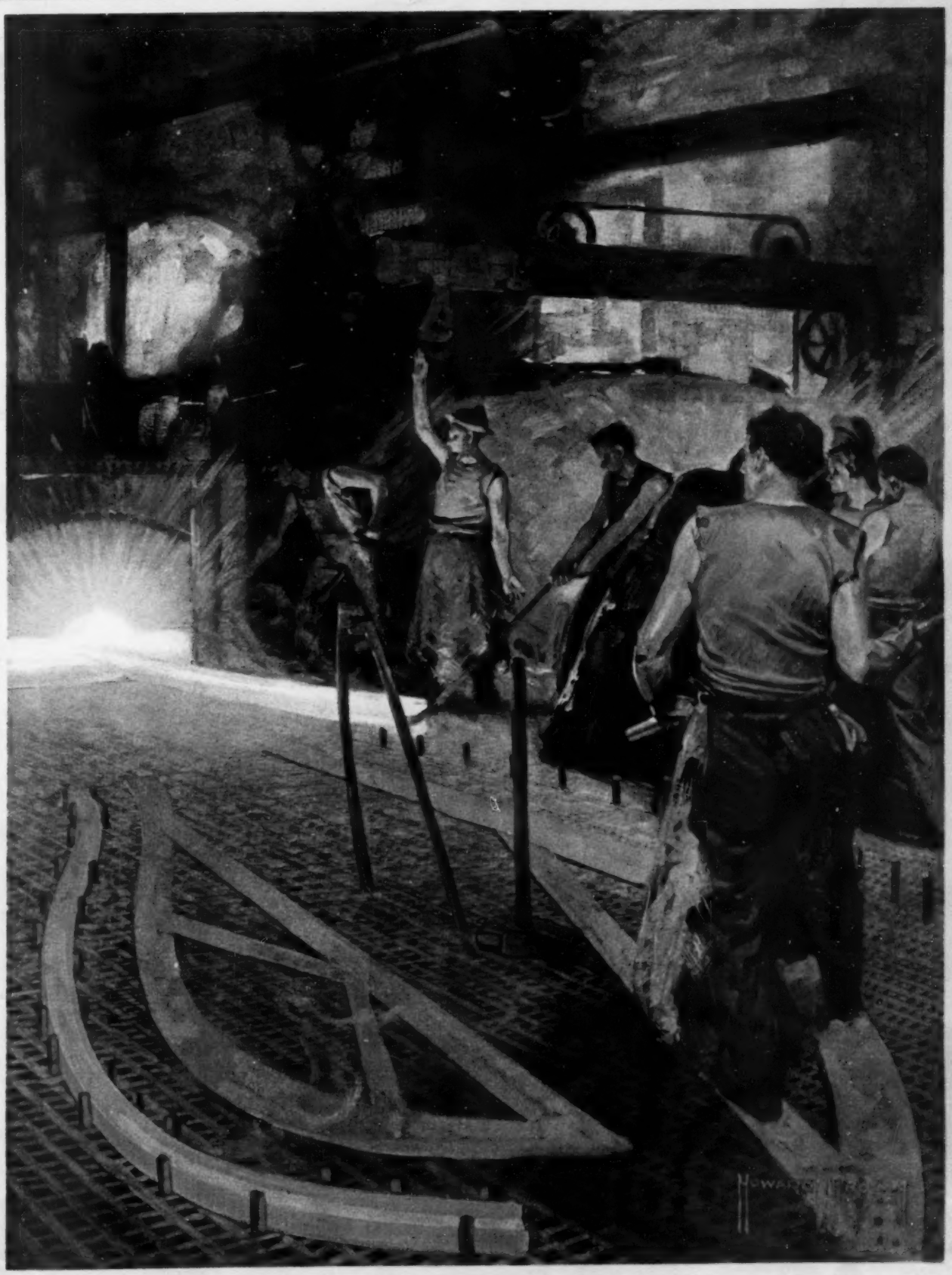
PONTIAC, MICH.

New York Philadelphia Boston Chicago
St. Louis San Francisco
Distributors Most Everywhere

NOTICE TO READER
When you finish reading this magazine, place a one-cent stamp on this notice, hand same to any postal employee, and it will be placed in the hands of our soldiers or sailors at the front. NO WRAPPING—NO ADDRESS.
A. S. BURLESON, Postmaster-General.

OCT 20 1917

SCIENTIFIC AMERICAN



BENDING SHIP FRAMES FOR OUR NEW MERCHANT MARINE

October 20, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Adaptable As Your Home!

SUMMER, winter, rain or shine—your home's your home!

It is a permanent structure—and yet, consider how it accommodates itself to the seasons, to your family, your social, your business requirements.

At no time is it a compromise. It is as ample and livable at one time as at another.

And so, too, with the Cole Eight Four-Door Toursedan.

It is equal to every motoring requirement—regardless of the weather—regardless of the occasion.

Transforming itself from open touring car to divided touring, family Sedan, Towncar-Limousine or Berline-Limousine as required, with no more difficulty than raising or lowering the windows in your home, it is sufficient unto your every need.

And like your home, it has all the appearance—all the advantages—of permanence in whatever condition it is used.

Its appointments include every feature of enclosed car equipment that makes for comfort and convenience.

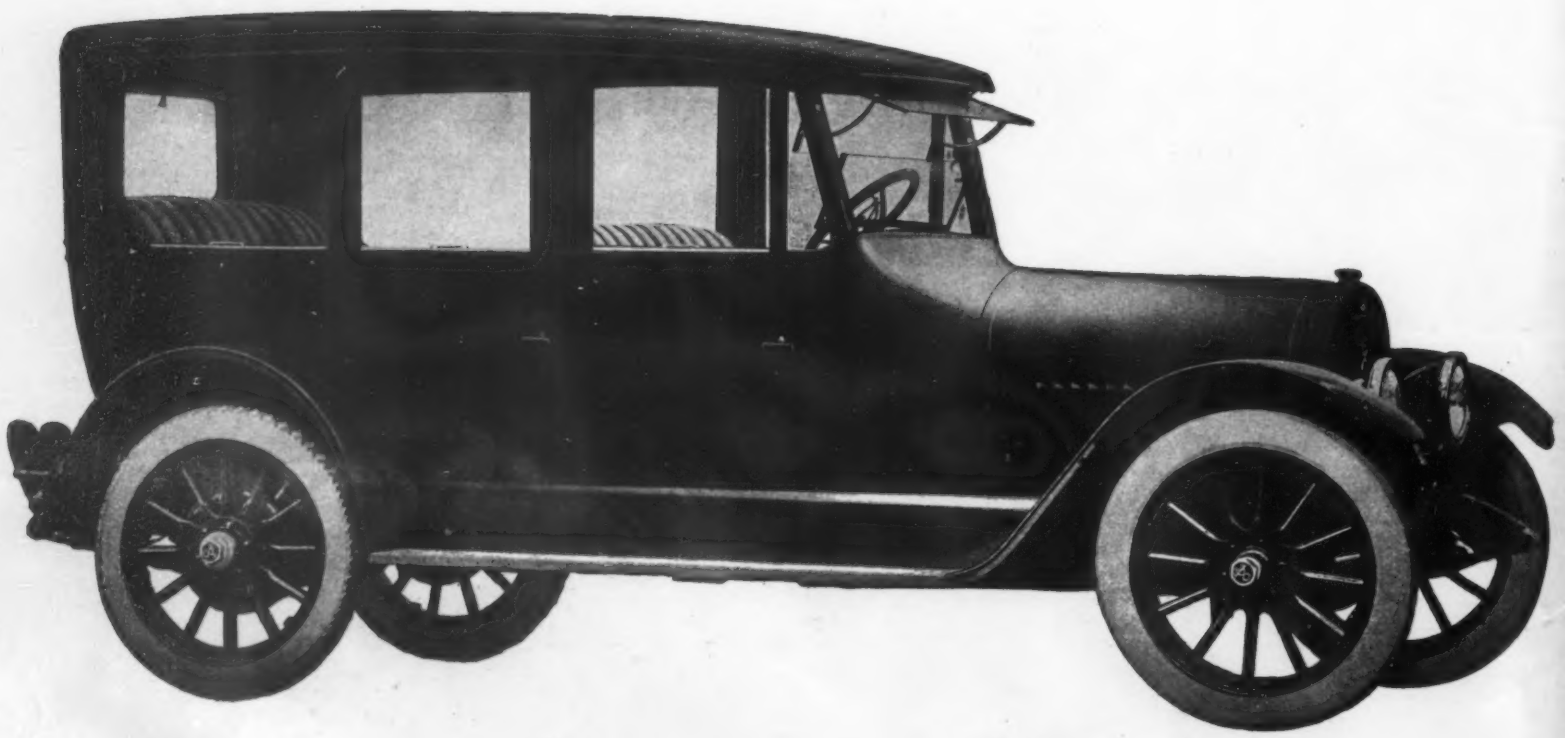
Go to your nearest Cole dealer and let him show you the new Cole Eight Four-Door Toursedan while you can take advantage of an immediate delivery.

Four-Door Toursedan Prices

7 passenger with divided front seats $2595
7 passenger with solid front seat $2695
8 passenger with 6 seats in tonneau $2795

Prices, Other Cole 8 Models

7 passenger touring car $1995
4 passenger Tuxedo roadster $1995
4 passenger Tourcoupe $2495

All prices f. o. b. factory and subject to change without notice

Cole Motor Car Company
Indianapolis, U. S. A.